ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 16, No. 11. WEEKLY.

NEW YORK, SATURDAY, MAY 10, 1890.

$3 per annum. Single Copies, 10 Cents.

Copyright, 1890, by Electrical Review Publishing Company, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

Alternate Current Flow.

BY FRANCIS B. CROCKER.

It is well known that rapidly alternating or rapidly varying currents tend to flow near the surface of a conductor more than in the interior, and when the alternations or variations are very rapid and the diameter of the conductor is considerable, the current almost all flows very close to the surface; in fact, it may be only skin deep.

Heretofore it has been generally thought that rapidly alternating or varying currents always have this tendency, and it seems important to point out definitely that such is not the case and why it is not.

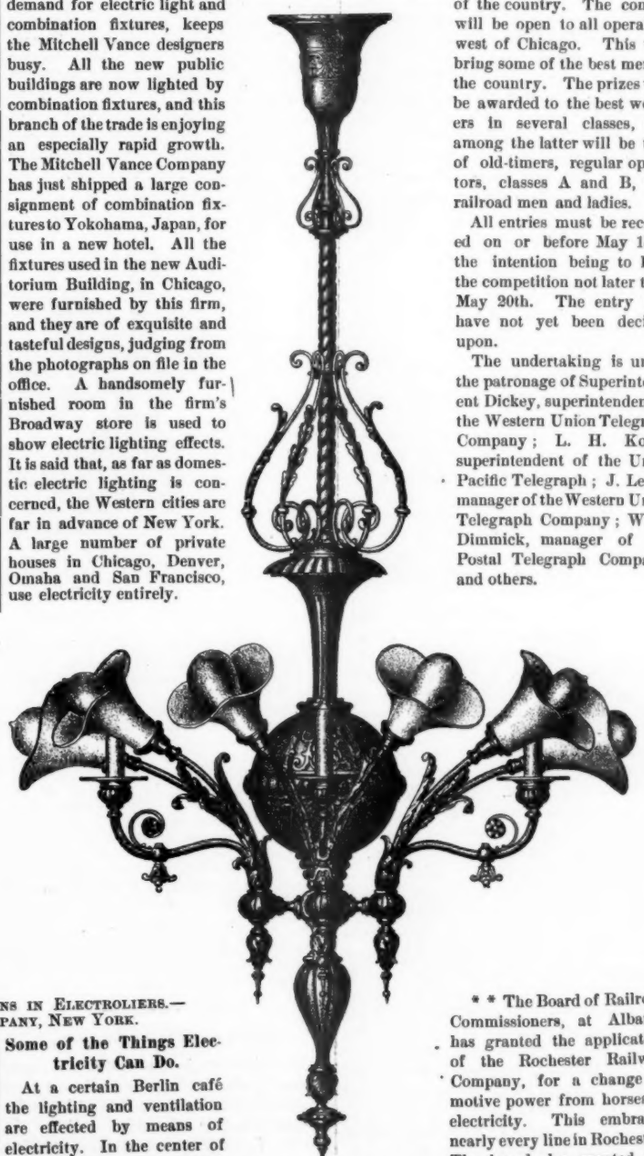
Sir Wm. Thomson, in an article on "The Time Integral of Induction Currents," in the *Philosophical Magazine*, March, 1890, states that this action tends to make the induction current on the break less than on the make, because the former is more rapid and would, therefore, be more confined to the surface.

At the end of the article, he says, in a postscript, that his ideas on this subject were incorrect, and later experiments seem to show that the two currents were perfectly equal. But he does not explain clearly why this is so, and it is difficult to tell whether the whole theory of this flow is wrong or whether it merely has exceptions.

As a matter of fact, this tendency of rapidly alternating or varying currents to flow near the surface does not exist in the case of currents actually under the inductive action which produces them, the secondary current of a converter, for example. The reason for this is that the induction acts upon the interior of the secondary conductor just exactly as strongly, and just as much current per square millimeter will be produced as on the outside.

The copper of the conductor does not affect the lines of force since it is a medium of substantially the same permeability as air, the whole mass of the secondary wire is uniformly acted upon; in short, this surface flow law does not apply within the inductive field. But as soon as the current passes out on the line wire, for example, where it is not under the inductive action and is not forced by this action to flow in the interior, then the current is only affected by the mutual action of its own parts, *i. e.*, self induction, and it flows for the most part near the surface of the conductor in the well known manner.

This difference of flow in the two cases has a very important practical bearing, for we see that the whole cross section of alternating current converter and armature conductors is utilized; therefore, they should always be solid; but only the surface of line wires is useful; therefore, they should be hollow; this, however, is hard to realize in practice.



FIGS. 1 AND 2.—NEW DESIGNS IN ELECTROLIERS.—MITCHELL VANCE COMPANY, NEW YORK.

New Designs in Electroliers.

The illustrations on this page are selected from the new catalogue recently issued by the Mitchell Vance Company, of this city. The electrolier with the umbrella top, made of silk, is a new departure in fixture designing, and the company thinks it will prove very popular. The constantly increasing demand for electric light and combination fixtures, keeps the Mitchell Vance designers busy. All the new public buildings are now lighted by combination fixtures, and this branch of the trade is enjoying an especially rapid growth. The Mitchell Vance Company has just shipped a large consignment of combination fixtures to Yokohama, Japan, for use in a new hotel. All the fixtures used in the new Auditorium Building, in Chicago, were furnished by this firm, and they are of exquisite and tasteful designs, judging from the photographs on file in the office. A handsomely furnished room in the firm's Broadway store is used to show electric lighting effects. It is said that, as far as domestic electric lighting is concerned, the Western cities are far in advance of New York. A large number of private houses in Chicago, Denver, Omaha and San Francisco, use electricity entirely.

A Western Tournament.

The telegraphers of Omaha, Neb., have decided to hold a fast telegraphing tournament. They are also determined to offer prizes which shall exceed in value those offered by their brothers in the metropolis, and which will undoubtedly attract lightning workers from all parts of that section of the country. The contest will be open to all operators west of Chicago. This will bring some of the best men in the country. The prizes will be awarded to the best workers in several classes, and among the latter will be that of old-timers, regular operators, classes A and B, and railroad men and ladies.

All entries must be recorded on or before May 15th, the intention being to hold the competition not later than May 20th. The entry fees have not yet been decided upon.

The undertaking is under the patronage of Superintendent Dickey, superintendent of the Western Union Telegraph Company; L. H. Korty, superintendent of the Union Pacific Telegraph; J. Levin, manager of the Western Union Telegraph Company; W. S. Dimmick, manager of the Postal Telegraph Company, and others.

Some of the Things Electricity Can Do.

One of the principal objects of the electrical exhibition which is to be held at Frankfort-on-the-Main, in 1891, will be to demonstrate which is the most economical method of transmitting and distributing electrical power in factories and wherever else it is used, instead of steam and other power. An instance of its application is seen in Berlin, where the girls in the largest cloak manufactory (Mannheimer's) sew on machines operated by electricity.

At a certain Berlin café the lighting and ventilation are effected by means of electricity. In the center of the room there are several large glass jars through which passes a platinum wire in spiral form. The electricity, on heating the wire, speedily raises the temperature of the water in the jars to boiling point, and prepares the coffee in the sight of everybody. Lastly, a small electric railway transmits the coffee to the various tables, so that the guests may help themselves to their liking.

* * The Board of Railroad Commissioners, at Albany, has granted the application of the Rochester Railway Company, for a change of motive power from horses to electricity. This embraces nearly every line in Rochester. The board also granted the application of the Utica and Mohawk Railroad Company, for a change of motive power from horses to electricity.

* * At Kensington, Conn., a factory has been started for the manufacture of the Sorley storage battery. The corporate name of the company is the Anglo-American Electric Light Manufacturing Company.

Electric Lighting in Chicago.

Some interesting figures are shown in the Fourteenth Annual Report of W. H. Purdy, Commissioner of Public Works, Chicago, in relation to electric lighting, of which the following is an extract:

"To our electric light underground system we have added 12,109 feet of conduit, 256,983 feet of iron pipe, 66 miles of electric light cable, 122 manholes and 44 hand-holes.

"The original wire plant, which was installed December 24, 1888, has been in continuous operation since, and the universal cry for electric lights from the various quarters of the city warrants me in saying they are giving satisfaction. The rebuilding and changes made in bridges, viaducts, etc., have necessitated the changing of a number of posts and cables; the department has made a large saving in repairs on lamps by having same done in electric light repair shop.

"The past year the greatest amount of work performed has been in construction of subways for electrical conductors. They were laid out and built according to the following general plan: The (old) city was divided into 12 electric light districts. Each district to have a power station located as near the center as possible; from each power station a main subway was to be built extending across the district from boundary line to boundary line, and decreasing in conduit space from the power station toward the boundary lines. From these, main feeders were to be run out at right angles to the line of the subway and reaching to the other boundary lines; from these feeders, connections are made to the lamps. On all streets where fire or police boxes, engine houses or police stations, are located, enough duct space has been provided to accommodate the underground wires necessary for these departments. A main subway of multitubular blocks of bituminous concrete was built in the north division, laid in the street and embedded on all sides with three (3) inches of concrete, composed of Portland cement, sand and limestone screenings, and reached by large octagon-shaped manholes,

"A similar subway was laid in the west and south divisions. The feeders throughout are two-inch iron and steel pipe laid under the sidewalks, inside the curb wall, wherever it was considered the best and most economical to lay them. Where laid in the street, small manholes and hand-holes were built. Work has been done in four of these districts.

"In District No. 1, the subways and feeders have been built, but cannot be utilized until a power station is provided.

"In District No. 4, the subways and feeders have been laid to supply 167 lamps on the main street of the district, a power station is built, cables laid, posts set and work of setting dynamos, machinery and boilers, is rapidly nearing completion.

"In District No. 6, 80 lamps have been added to those already in the district. The power house is finished, and the setting of dynamos, machinery, boilers, etc., is being pushed as rapidly as possible.

"The power house in District No. 8 is nearly completed, and feeders have been laid to connect 119 lamps. In this district the feeders and cables have been laid so as to connect with the main subway.

"In undertaking to light a portion of several districts, the proportionate cost per lamp is necessarily much greater than if the whole of each district could be lighted at once, as the land, buildings and subways, must be provided for the entire district, and only a portion of them used.

"As, for instance, we have built during the year 126,399 feet of conduit in the main subways, and will use 36,539 feet, leaving 89,860 feet for future use. A still greater proportion of the land purchased and buildings erected cannot be used until each district is supplied with the proper number of lamps. Of the pipe laid for feeders, about two-thirds of the cable room will be occupied at once, leaving one-third for future use.

"When the lamps to which the feeders are now laid are connected, we will have about 120 miles of cable in service and 651 lamps; whereas, if the four districts through which these cables extend were completed, the same amount of cable would supply 1,000 lamps. An electric light post possessing some peculiar advantages has been designed and adopted. It consists of a hollow iron base extending from the sidewalk to the height of seven (7) feet, a hollow wooden pole extending through the iron base to the height of nine (9) feet above the iron base, the wooden pole being firmly secured to the top and bottom of the iron post.

"There are two doors on the opposite sides of the iron base at a height of five (5) feet from the sidewalk and removable panel near the bottom, a frame and hood extending from the top of the pole, and having but one standard or support. Inside of one of the doors is placed a wooden box containing a double pole arc light switch; in the other there is a receptacle for a fire alarm box. The panel can be removed to facilitate the handling of cables. The advantages of the pole are many. First and pre-eminent in importance is the safety it offers to human life, as in case of accident to the lamp the workman can entirely disconnect it from the rest of the circuit without a possibility of contact with the conductor, by throwing the switch near the base of the pole. The wooden pole is a semi-insulator, and is much safer to work from than an iron pole, should it be necessary to regulate the lamp while burning. The hollow space between the wooden and iron poles offers a receptacle not only for an electric light switch and fire alarm box, where the latter is needed, but if in the future the city should need incandescent lights for city or private use, there is room for a converter by which a high tension current can be changed into a low tension current for incandescent lighting. The single standard or support for the lamp only gives off one shadow, and that can be directed against the part of the nearest building where it will be the least objectionable.

"The electric light underground system now comprises 12,169 feet of conduit, 398,744 feet of iron pipe, 120 miles of electric light cable, 164 manholes and 125 hand-holes."

Extracts taken from other parts of the report show that there are 32,744 gas and oil lamps in the city, costing, to maintain, $627,766.73, while 651 arc lights are maintained for $27,444.73.

The commissioner, in speaking of the Chicago River, says: "The lighting of the river by electricity still proves a great assistance in the movement of vessels at night, and should be extended along the entire river, as soon as circumstances will admit. The system, as operated, is greatly appreciated by navigators of the river, and vessel owners."

Mr. Purdy's report throughout is a very able one, and shows that the officials in charge of the electric light extensions have not been idle the past year.

Another Industry for Lynn.

Great interest is manifested at Lynn, Mass., in the probable establishment of another electrical industry at West Lynn, for the manufacture of welded shells. The works of the Thomson Electric Welding Company are crowded to their utmost capacity in the manufacture of welding machines, which will be used largely in the new industry. As soon as the patents of Lieutenant Wood, U. S. N., for welding shells were brought to the attention of the government, there was a prompt appreciation of their value, and an order was at once placed for 100,000 shells for Hotchkiss guns and Shrapnel shells, as soon as facilities were ready for making them.

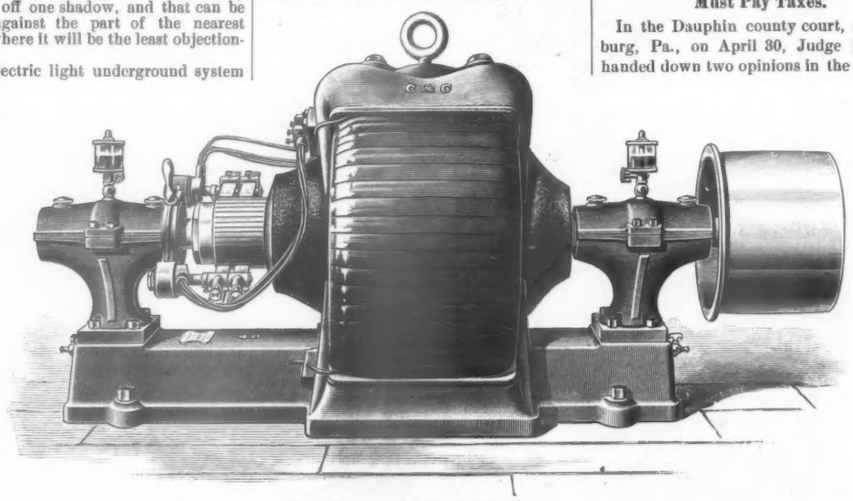
Electric Railroads in the Census.

To the Editor of Electrical Review:

The use of electricity as a motive power for street cars will be an important section of the census investigation of the electrical industry. None of the many forms of the application of electricity has been developed more rapidly, or accompanied by more satisfactory results, than that of the transmission of power for street car purposes.

The census investigation of the general subject of transportation has been very properly assigned to Prof. Henry C. Adams, statistician of the Interstate Commerce Commission. He has divided the subject in several sections, one of which is "Rapid Transit in Cities." This section has been assigned to Special Agent Charles H. Cooley, a son of Thomas M. Cooley, chairman of the Interstate Commerce Commission.

The plan of investigation that has been adopted is designed to make a comparison between the different motive powers employed—animal, steam dummy, cables and electricity—to show the relative economic value of each. Electricians can wish for nothing better than this. The only danger is, that they will experience from it an embarrassment of success. Street railroads are now being transformed into electric roads as fast as manufacturers and construction companies can take care of the business. How they will manage with an added impetus given to the business is hard to predict. We are now witnessing the fulfillment of a prophecy made in 1889, regarding the adoption of electric motor power by all street car roads in the country.



New Style of "C. & C." Motor.

* "*The change will not be a development. It will be a transformation.*"

If the investigation by the Census Office, of the relative economic value of the motive powers now in use for street car service, results as I believe it will, the "horse car horse" will disappear. The places that know him now will know him no more.

The schedules for the section of rapid transit in cities will include the inquiries to be made regarding electric railroads. That part of the schedules pertaining to the electrical branch of the subject will be prepared under my supervision, and that portion of the report pertaining to the uses of electricity as a motive power for street cars will be embodied in my report on the investigation of the electrical industry, as well as in the report of the section making the investigation.

The Census Office is performing a service of great value for the public in making such special investigations. All who have to do with questions of municipal management or public affairs, are keenly aware of the necessity of securing reliable data by which to guide their actions. The cost of obtaining such statistics through the Census Office is but an infinitesimal tax on the capitalization of the industries interested, while its impartial and impersonal character gives it the weight of an unquestioned authority.

Mr. Cooley is anxious to have electric railroad men impressed with the great help they can give him by filling out and returning their schedules promptly. I tell him that he will find in this, as in all other matters, electrical men lead the world. They can't help it. It is the nature of the "fluid" they imbibe to make them "quick as lightning."

Allen R. Foote,
Special Agent.

* "Economic Value of Electric Light and Power," page 121.

Another New Motor.

The "C. & C." electric motors are now constructed on their new designs in the circular form, in all the usual standard sizes, from one horse-power to 50 horse-power.

The accompanying cut was taken from the most approved and latest form of their 25 horse-power motor. The most striking feature of these machines is the shape of the magnetic circuit, which forms a perfect circle around the center of the armature shaft.

This construction gives the shortest possible magnetic circuit, it is free from corners and projections where leakage may occur, and makes the motor very compact for a given power.

The advantage of this form of construction is shown by the remarkably small amount of current absorbed by the various sizes when running either with or without any load. This fact has been conclusively proven by some recent tests in New York city and Chicago, where it was found that they absorbed less current than any other make of motor of equal power, and the company would be glad to submit figures illustrating this fact.

The larger sizes are fitted with self-oiling bearing, or sight feed oil cups are provided at the option of the user. The speeds are relatively slow, that of the 25 horse-power here represented being 350 revolutions per minute.

Electric Light Companies Beaten.—Must Pay Taxes.

In the Dauphin county court, at Harrisburg, Pa., on April 30, Judge Simonton handed down two opinions in the Common-wealth cases against the Philadelphia Electric Lighting Company and the Brush Electric Light Company, of the same place. Both claim to be manufacturing companies, and as such to be exempt from taxation under the recent act taking the tax off manufactories. Judge Simonton adheres to his opinion that producing electric light is not a species of manufacture. He held neither electricity nor electric light is a material substance; that there could be no manufacture unless some material substance was produced. It is expected these cases will be argued in the Supreme Court on appeal at its meeting here in June.

In these cases a great deal of evidence was taken to show the unequal operation of the present tax laws upon different corporations. The lack of uniformity, it was claimed, made the tax unconstitutional. Judge Simonton, however, sustains the constitutionality of the tax, except to the amount invested in patent rights.

Electro-Motive Force.

A large audience assembled one evening last week in the lecture hall of the Brooklyn Institute, to listen to an interesting discourse delivered by Professor Robert Spice, of the Central Grammar School, on "Electro-Motive Force." He spoke of the pressure of water being produced by the difference of levels and the attraction of gravitation, but said that electro-motive force was regulated in a measure by the difference of levels alone.

The professor illustrated his lecture with many interesting experiments.

The Burton Electric Heater.

The Burton electric heater has come to be recognized as an invaluable part of the equipment of an electric railway. It is manufactured by the Burton Electric Company of Richmond, Va. For our illustrations we are indebted to the *Street Railway Journal*.

Fig. 3 shows two views of this heater. One represents it with the top on and ready for use, and the other with the top off, exposing the arrangement of the resistance wire on the inside. Before use this is covered with dry powdered fire clay and the top screwed down, care being taken to have the joints thoroughly packed to prevent the escape of the fire clay. The outer casing is of ordinary cast iron having a coating of asphalt or other varnish, and its dimensions must be such as will be suited to the space it is to occupy. In is adaptation to electric cars, it is made 27 inches long, eight inches wide, and is mounted on iron legs which raise it about four inches from the car floor. Fig. 1 is a ground plan of an electric car, showing the position of the heaters, *A*, *A*, *A*, *A*. Fig. 2 is a cross section of the same, showing the heater under the seat resting on a tin or zinc reflector, *B*, which throws the heat into the body of the car. Fig. 4 is a diagram showing the wiring of the heaters, by which their efficiency is very much increased. By referring to this it will be seen that two switches, one line and two ground connections, are necessary to get the best results. The line connection should be made with the trolley wire which usually runs down in a corner of the car before it enters the motor switch on the platform. The ground connections should be made with the iron side bar on the motor truck, one on each side. By this method of making these connections these heaters are entirely independent of the motors; and, besides, there could be no possibility of danger to workmen while oiling or repairing the motors.

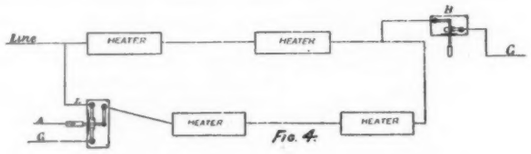


Fig. 4.

For the special service of warming electric railway cars, the electrical resistance of the heaters is so regulated that on a 450 volt circuit, connected in series of four, they will use three amperes of current. When, therefore, the handle of the switch *A* is turned on *L* ("shunt" from line connection) and the switch *B* closed, the heaters are thrown in series of two for a short time only, causing the use of six amperes of current in each set. When a sufficiently high temperature has been attained in these—which will be in 15 or 20 minutes—the handle *A* is turned on *G* (ground connection) and the switch *B* opened. This causes them to be thrown in series of four, when the heat will be maintained in them for a long time without being appreciably lowered, with the use of only three amperes of current.

The electric railways which have been equipped with this device are emphatic in their praise of it. The committee on science and the arts, of the Franklin Institute, recommended the award of the Scott legacy award to this heater.

The novel experiment of boiling eggs by electricity was tried in the office of the Electric Supply Company, recently. Of course, they were boiled in water, but electricity was the heating agent. Luke Lilley, the city's assistant electrician, was chief cook. Charley Marshall, the underwriter's agent, ate the first egg boiled by the agency of the subtle current. It required six amperes and 96 volts to accomplish the operation with about two quarts of water in a huge tin cup, the electrical current being connected through the handle of the cup. The news of the egg boiling spread quickly, and, as it was about lunch time, brokers, bulls and bears, bankers, insurance men and lawyers, crowded the office. About 13 dozen eggs were consumed.—*Cincinnati Times-Star.*

Gas and Electric Consolidation.

In the Massachusetts House, on April 30th, Mr. Palmer, of Middlesex, opposed the amendments of Mr. Pinkerton, of Worcester, to the bill to authorize the consolidation of gas and electric light companies, on the ground that, instead of perfecting the bill, they were calculated to kill it. Mr. Pinkerton said that he had no objection to the union of gas and electric lighting companies where it was in the interest of the public that it should be done. His amendments were in favor of what was sought by the bill, but they provided for a unanimity of action in fixing the value of property, and that the aggregate stock shall be limited to the total amount of the two companies. This gives the new company the actual working capital of the two companies. He did not propose to vote for speculative measures. He proposed to vote for fair and honest consolidation. Mr. Metcalf, of Hampden, considered the bill as reported an honest and just one, and, although the amendments came from the hand of Esau, there was the voice of Jacob behind them, and they were intended to kill the bill. They would prevent the consolidation of companies contiguous but on different sides of the dividing line between two towns. It would prevent the city of Cambridge from enjoying the advantages which would come from consolidation with a company across the river in Boston. The amendment relative to amount of capital stock was manifestly unfair, as it would admit a company like the Dedham Company, with assets of only $45,000, to issue stock to the amount of $100,000, and it would compel a company with $150,000 assets to capitalize for only $100,000.

Mr. Pinkerton said there were 79 gas companies in the State, with a valuation of $12,000,000, and, although they complained that they were not making money, with the exception of the Marblehead Company, they paid six per cent. and upward, and it was taken directly out of the consumer. He objected to allowing companies in Cambridge and Boston to consolidate, they having no interest in common. Mr. Metcalf said that the bill was a permissive bill, and was as much in the interest of the small companies in Berkshire as of the large companies of Suffolk. Mr. Creed, of Suffolk, said the bill prevented competition and was, therefore, not in the interest of the people. Mr. Metcalf replied that it was directly in the interest of the people, inasmuch as it decreased expenses, and, therefore, would decrease the price of lighting. Mr. Creed took the opposite ground, that where there is no competition, prices would increase. All of the amendments were rejected, and the bill passed to be engrossed, by a nearly unanimous vote.

A Long-Lived Lamp.

The Sawyer-Man Electric Company, of this city, are in receipt of a communication from one of their correspondents in Gadsden, Ala., in which is mentioned an incandescent lamp which has seen long service. The lamp in question has been burning every night in the station of the Queen City Electric Light Company, since July 4, 1888. This means 665 days of 12 hours, or a total of 7,980 hours. The lamp is a Sawyer-Man 16 candle-power, burning at 110 volts, and is still in use.

The Cartwright Protector.

At 146 Franklin street, Boston, the protector, which we mentioned in a recent issue, is in daily operation.

This instrument has proved effective at the City Hall in fire alarm service in diverting a static charge of great intensity, protecting all instruments on that circuit within the building from the effects of lightning. On telegraph, telephone and other grounded circuits, the protector and fuse are located so that the normal current passes first through the fuse, then to the coil of the protector, from there to the armature, from the armature to the instrument to be protected,

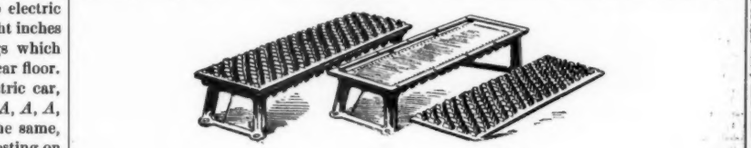
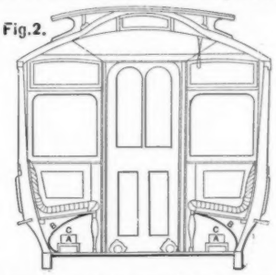


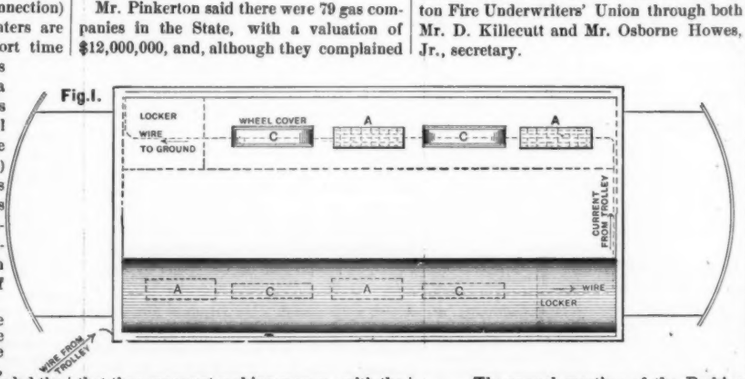
Fig. 3

Fig. 2.



and connects with the core of the instrument, which is connected with the ground, thus avoiding all contact stops and insuring certainty of action. Unlike other instruments, it is not dependent upon contacts or good ground connections, as it will operate through a ground resistance of 2,000 ohms. It has received the indorsement of the Boston Fire Underwriters' Union through both Mr. D. Killecutt and Mr. Osborne Howes, Jr., secretary.

Fig. 1.



The annual meeting of the Perkins Electric Lamp Company, of Manchester, Conn., was held last week, and a dividend of 10 per cent. was declared. It was voted to move the main office to Manchester, as soon as suitable quarters could be obtained. The old Board of Officers was re-elected, as follows: President, M. S. Chapman; vice-president, W. G. Halm; secretary, J. J. Gates; treasurer, C. T. Welles; directors, M. S. Chapman, J. J. Gates, W. G. Halm, W. B. Whiting and C. T. Welles.

Mr. W. J. Hammer, who was in charge of the Edison Exhibit at the Paris Exposition last year, just returned in good health from Florida, where he has been spending the winter.

Burlington, Ia.—Burlington Electric Railway Company. Capital, $650,000.

Pittsburgh, Pa.—Michales Electric Mining Machine Company; capital, $500,000.

Girard, Kan.—The Girard Gas and Electric Light Company. Capital stock, $25,000.

New Braunfels, Tex.—The Landa Electric Light and Power Company has been incorporated.

Chester Valley, Pa.—The Chester Valley Electric Light and Power Company. Capital, $1,000.

East Liverpool, O.—The East Liverpool Electric Company has increased its capital stock from $18,000 to $25,000.

Allegheny, Pa.—Terry Street Railway Company; capital, $100,000.—Allegheny and Bellevue Street Railway Company; capital, $6,000.

Portage, Wis.—The Portage Electric Light Company; capital, $15,000. Incorporators, William Kutzke, Frederick W. Kutzke and Henry M. Forbes.

San Francisco, Cal.—The California Electric Transfer Company, with $1,000,000 capital. Directors: M. Livingston, A. Lefort, G. M. Ashe, Otto Belan and John M. Patterson.

Indianapolis, Ind.—Crown Point Electric Light and Street Railway Company. The company has $200,000 capital stock, and F. B. Clarke, John F. Leavsey and others, are directors.

Quincy, Ill.—The Electric Wheel Company, to manufacture metal wheels by the use of electricity; capital, $25,000. Incorporators, S. R. Emory, Jr., Thomas Hill and C. G. Comstock.

Detroit, Mich.—Shawhan Electric Motor Company. Capital, $2,000,000. Directors, F. B. Dickerson, C. H. Smith, H. H. Humphrey and J. F. Shawhan. Object, to make motors for storage battery cars.

Chicago, Ill.—Electric Merchandise Company; to manufacture machinery used in the construction of electric railroads; capital stock, $50,000; incorporators, Cyrus Emery, John L. Ludwig, William R. Mason.

Memphis, Tenn.—Volta Electrical Manufacturing Company. The incorporators are: J. W. Allison, B. M. Stratton, F. S. Carman, D. T. Porter, R. C. Graves, W. M. Sneed, M. M. Gilchrist, Elias Lowenstein and R. L. Coffin.

Kalamazoo, Mich.—Kalamazoo Electric Light Company; capital stock, $30,000. The following are the officers: President, Giles C. Burnham; vice-president, George E. Stockbridge; secretary, George T. Goodenow; treasurer, Horace Prentice.

New Hartford, N. Y.—Sauquoit Valley Electric Street Railroad Company. Directors are: Benjamin Goff, George A Butler, Thomas H. Cackett, H. Lee Babcock, Albert P. Seaton, Richard W. Sherman, Bradford C. Divine, Charles H. Philo, Morgan Butler, Thomas B. Cloyes, James Armstrong, Israel N. Terry, all of whom live in the town of New Hartford.

Spokane Falls, Ore.—The Inland Telegraph and Telephone Company, replacing the Sunset Hopkins system, has been organized, with a capital of $300,000, paid up. W. S. Norman, of Spokane, is president; J. S. Sabin, of San Francisco, vice-president; Charles Sibley Smith, secretary; C. B. Hopkins, manager; C. P. Irvine, of Spokane, superintendent.

ELECTRICAL REVIEW

Published at 13 Park Row
P. O. BOX 3329.

GEO. WORTHINGTON, - - Editor.
CHARLES W. PRICE, - Associate Editor.
T. J. McTIGHE, Electrician and Manager Patent Bureau.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"546 JOHN," TELEPHONE CALL.

BOSTON OFFICE:
W. I. BARKER, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1419 New York Ave.

CHICAGO OFFICE:
D. B. DEAN, 61 Metropolitan Block.

EUROPEAN OFFICE:
CHARLES FFRENCH, Bridge House, 181 Queen Victoria St., London, E. C.

SUBSCRIPTION TO THE ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy. - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, MAY 10, 1890.

CONTENTS.

	PAGE.
Alternate Current Flow	1
New Designs in Electroliers	1
Some of the Things Electricity Can Do	1
A Western Tournament	1
Electric Lighting in Chicago	2
Another Industry for Lynn	2
Electric Railroads in the Census	2
Another New Motor	2
Electric Light Companies Beaten.—Must Pay Taxes	2
Electro-Motive Force	2
The Barton Electric Heater	3
Gas and Electric Consolidation	3
A Long-Lived Lamp	3
The Cartwright Protector	3
New Corporations	3
Execution by Electricity	4
Correspondence:	
Our Washington Letter	5
Our Boston Letter	5
Our Chicago Letter	5
Our Albany Letter	5
An Austrian Firm Sues the Edison Company	5
A Removal	5
Personal	5
Telephonic News	6
A New Telephone Exchange for Kansas City	6
Street Railway Materials	6
Rules for Electrical Work	6
Electric Power	8
Baxter Electric Motor Company	8
No Execution by Electricity Just Yet	8
A Big Electrical Storm	8
The Microbe of the Magnet	8
The Patent Office	8
General Electrical Notes	8
Our London Letter	9
The Wenstrom Consolidated Dynamo and Motor Company	9
The Russell Electric Lamp	9
Electric Light News	9
Mr. Pierce Not Guilty	9
Kindred Interests	10
A New Insulator	10
Cardew Earthing Device	11
Lighting the Statue of Liberty	11
Remarkable Telegraphy	11
Electrical Patents	11

INDEX OF ADVERTISERS.

COVER PAGES.

Ansonia Brass & Copper Co	4
Armington & Sims	4
Bridgeport Brass Co	4
Brush Electric Co	3
Chadbourne, Hazelton & Co	2
Davis, Charles H., Electrical Engineer	4
Day's Kerite Insulated Wires	4
Eastern Electric Cable Co	4
Edison Pressure Recording Gauges	4
Hampson, G. & Co., E. P.	4
Jewell Belting Co	4
Moore, Alfred F	4
Okonite Co	4
Simplex Electrical Co	4
Standard Underground Cable Co	4
Tucker Electrical Construction Co	4

INSIDE PAGES.

Aluminum Battery Electric Light & Power Co	18
American Bell Telephone Co	20
American Electrical Works	12
Babcock & Wilcox Co	26
Baird & Co., Henry Carey	11
Baker & Co	12
Ball Electric Light Co	19
Ball Engine Co	13
Baxter, H. E. & C	24
Bishop Gutta-Percha Co	25
Blanchard, C. M	12
Brownlee & Co	25
Brush Electric Light and Power Co	23
Buckeye Engine Co	13
Burton Electric Co	18
Butler Hard Rubber Co	14
Cary & Moen	26
C., B. & Q. R. R	23
"C. & C." Electric Motor Co	14
Central Electric Co	26
Clark Electric Co	12
Cleveland, W. B	28
Continental Dynamo Co	18
Cowles, Eugene H	11
Cutter, George	13
Daft Electric Light Co	21
Dwight Slate Machine Co	26
Easton Electric Co	12
Eclipse Wind Engine Co	13
Eddy Electric Manufacturing Co	23
Edison Machine Works	24
Edison Lamp Co	28
Edison Manufacturing Co	14
Edwards, S	11
"Electric"	11
Electric Gas Lighting Co	16
Electric Mutual Insurance Co	17
Electric Safety Co	25
Empire China Works	20
Empire City Electric Co	17
Eugene F. Phillips Electrical Works, Ltd	12
Eureka Tempered Copper Co	22
Excelsior Electric Co	21
Faraday Carbon Co	23
Fort Wayne Electric Co	28
Garvin Machine Co	13
Gassner's Dry Battery	24
Gethins Electrical Manufacturing Co	20
Gibson Gas Fixture Works	13
Goodrich Rubber Companies	22
Gordon & Co., W. H	12
Greeley & Co., The E. S	23
Hammond Typewriter Co	19
Heisler Electric Light Co	26
Holmes, Booth & Haydens	21
Horn, Brannen & Forsythe Manufacturing Co	20
Ide & Son, A. L	23
"Industries"	24
Interior Conduit and Insulation Co	18
Jarvis Engineering Co	13
Lane & Bodley Co	22
Leclanche Battery Co	12
Leffel & Co., James	25
Lehigh Valley Creosoting Co	20
Lynch, E. T., Jr	12
Macfarlane & Co., Wm	12
Marshall, Wm	11
Mitchell Vance Co	25
National Carbon Co	19
National Tel. Manufacturing Co	11
Newark Machine Tool Works	18
New England Butt Co	13
New York Belting & Packing Co	22
New York Electric Supply Co	12
New York Insulated Wire Co	18
Ostrander & Co., W. R	20
Page Belting Co	23
Palermo Mica Co	18
Parker-Russell Mining and Manufacturing Co	23
Partrick & Carter	19
Pennsylvania Railroad	19
Phœnix Glass Co	12
Phosphor-Bronze Smelting Co., Ltd	22
Pond Engineering Co	13
Post, Jr., & Co., John	18
Proposals for Street Lighting	11
Proposals for Supplies	11
Queen & Co., James W	12
Railway Directory Publishing Co	23
Rice Automatic Engine	13
Ricketts Co., Limited (F. M.)	22
Royce & Marean	22
Santley & Co., W. R	23
Sawyer-Man Electric Co	27
Schoverling, A	24
Schuyler Electric Co	25
Seely & Taylor Manufacturing Co	24
Shultz Belting Co	17
Southern Electrical Supply Co	17
Solar Carbon and Manufacturing Co	18
Sperry Electric Co	22
Sprague Electric Railway & Motor Co	20
Stephenson Co., Ltd	24
Stevens & Babcock	22
"Street Railway Journal"	19
Sunlight Carbons	22
Taber, Arthur H., Agent	11
Thackara Manufacturing Co	28
Thomson-Houston Electric Co	16
Trinidad-Heimann Insulated Wire Co	19
Tropical American Telephone Co., Ltd	19
Tucker Electrical Construction Co	28
U. S. Electric Lighting Co	15
Vincent & Co., Charles R	13
Wainwright Manufacturing Co	22
Washburn & Moen Manufacturing Co	22
Watson & Stillman	20
Weitmeyer Furnace	19
Western Electric Co	23
Westinghouse Electric Co	15
Weston Electrical Instrument Co	18
Whipple Co., Fred. H	18
White, R. T	25
Williams & Potter	13
Wilson & Co., R. D	11
Wyckoff Pipe Co	12

Several months ago the REVIEW called attention to the possibility of the discussion over execution by electricity resulting in the enactment of a law abolishing capital punishment in this State. The present indications are that we may lay claim to having a very wide-awake prophet in this office.

Is the electric railway an improver of property? Of course. Look at this; here's the River View Improvement Company, of Richmond, Va., suing the Richmond Union Passenger Railway Company, for $100,000. Why? Because the electric railway tracks were not extended to River View by March 1st. The amount named, therefore, must represent the increase in value which the electric railway would have added to River View property in just two months.

Professor Cyrus F. Brackett, in an address before the New York Electric Club, on December 20th, 1888, expressed himself as follows: "I may say at the outset, that, notwithstanding the fact that in New York it is the law that all persons convicted of offenses that are punishable by death are hereafter to be executed by means of electricity, my belief is that never a single man will die, except accidentally, by that means." At that time, the REVIEW stated in an editorial that Professor Brackett was a man "who looks a long way into the future," and predicted that his assertion would prove a true prophecy. Recent developments in the Kemmler case tend to verify the prediction.

The article upon "Alternate Current Flow," which appears in this issue, is of considerable scientific and practical importance. It will be noticed that in his ideas on the subject, Professor Crocker differs from Sir William Thomson.

It will be noticed that Mr. Pierce, of the Brush Company, of this city, was acquitted of the charge of manslaughter brought against him. The action was in the nature of a test case, but was a poor selection, as the testimony set forth in the trial clearly showed. In fact, the judge remarked that the prosecution scarcely had proof enough to send the case to the jury.

Hon. Daniel L. Gibbens, ex member of the Board of Electrical Control, New York, died, last week, from a sudden attack of pneumonia. Mr. Gibbens was the most energetic member of the electrical board, and, although quite a young man, had become prominent in political and electrical circles of this city. He was a member of the Electric Club, the Manhattan and several other New York clubs.

During the Kemmler excitement, Auburn was crowded with newspaper boys. They made the best use possible of the few electrical terms at their disposal, and some of the applications of said terms were paralyzing. A correspondent of a New York paper capped the climax when he ended an exhaustive article with the blood-curdling announcement that the death blow would be caused by "closing the switchboard."

Mr. George Westinghouse, Jr., very emphatically denies, in a letter to the daily press of New York, that he or his associates, or the Westinghouse Electric Company, had anything to do with securing a stay in the Kemmler case. Mr. Westinghouse also emphatically denies that he or his associates assisted in any way in securing legislation abolishing capital punishment in this State, some of the papers of the city having charged this recent act of the Assembly to him.

Telephone makers are not so dead in England as they would seem to be, judging from the modicums of telephone news which reach us from over the water. The Sheffield Telephone Company a short time ago extended their system to Bakewell (Derby), opening an exchange in that place. The inhabitants of Bakewell seem to have lots of telephoning, too, as the National Telephone Company have just opened a rival exchange there. The unique feature of the whole business is that both switchboards are installed in the same room.

EXECUTION BY ELECTRICITY.

One cannot see clearly when there is dust in the air. During the months of discussion relative to the electrical execution law, so many conflicting and contradictory arguments have been advanced by plausible speakers and writers, that the general public may well be excused for having often had a more or less clouded view of the real questions at issue. The unexpected writ of *habeas corpus* granted Tuesday of last week by Judge Wallace, of the United States Circuit Court, on application of Mr. Roger M. Sherman, has in some way had the effect of wonderfully clearing the vision of the daily press. No new ground for the unconstitutionality of the law has been advanced, but it seems as though a clearer definition will be demanded of those two words "cruel and unusual," which have played so large a part in the defense of, and attack on, the present law. Mr. George Tichnor Curtis is of the opinion that the degree of cruelty is not the question, for, of necessity, all violent deaths are cruel—a position we shall dispute later on—but that the word "unusual" is capable of a broader construction than has yet been applied to it in this connection. He quotes the case of Socrates, who was made to drink a decoction of hemlock, which produced a slow and lingering death; yet this was not an unusual form of punishment among the Greeks.

To the average citizen it may, perhaps, seem that law is stronger than justice when a man who richly deserves it should be snatched from the jaws of death—as was Kemmler—for the purpose of giving lawyers an opportunity to wrangle over nice points of law, with the possibility of a number of criminals escaping punishment.

In regard to the constitutional provision, it is interesting to notice that it is not stated, either in the State or the Federal Constitution, that the punishment shall not be *painful*, but that it shall not be *cruel*. Now, a painful death need not of necessity be a cruel one; on the other hand, much cruelty could be exercised without the infliction of much pain or suffering. Cruelty presupposes the desire to produce suffering It would be very difficult to devise a form of death which would be more terrorizing to the subject than the proposed method of electrical execution, with its complicated death chair and other paraphernalia. Compared with it, the death of Socrates—produced, by the way, by a drug largely used now by physicians, under the name of conium, for allaying nervous irritability—was merciful. Very probably the commission of scientific amateurs who recommended electrical execution were merciful in their intent, but to carry out their recommendation would be the personification of cruelty, even though the actual severing of life by electricity might be painless, which, however, is a subject in regard to which we have absolutely no evidence, though there is strong reason to believe it would be intensely painful.

Suffering usually precedes death, but we have no evidence that at the actual moment of death there is any suffering, or that there is greater suffering when the death is produced in any particular way. All we know is that people suffer before they die and that the anticipation of death in itself is intense suffering. How easy, then, to save the criminal all the agony of anticipation, if that is desirable. By causing the criminal, while asleep, to inhale the vapor of ether, or better still, chloroform, in sufficient quantities, he would pass into the great unknown without any suffering, save the actual extinguishing of the vital spark, in regard to the pain of which we have absolutely no knowledge. Now, if a law was rushed through the Legislature prescribing the use of ether or chloroform for executing criminals, every physician in the land would rise in righteous indignation, on the ground that such a law would intimidate and prejudice the public against an established practice of their profession; and yet it is not at all uncommon for chloroform, even when administered by physicians, to produce accidental death. A case in point is that of Mrs. William A. Harper, who died last week from the effects of inhaling chloroform for a dental operation, having twice within the few previous days inhaled chloroform without serious results. The use of chloroform as a legal executioner would undoubtedly result in its entire abandonment by physicians.

Why should not the great electrical fraternity be entitled to the same consideration as the medical profession?

Every unprejudiced person knows that the requirements of modern civilization demand the use of agencies, which, if uncontrolled, will surely become dangerous. Every unprejudiced electrician knows that the demands of modern electrical engineering require the use of potentials which will surely be dangerous if carelessly handled.

The substitution of electricity for hanging is a complete revolution of the practice of the civilized world, and the prostitution of a noble science and art to a base practice which has become obsolete in many of the most advanced countries of the world.

It is almost as pitiful to see the great State of New York intrusting the administration of one of its gravest powers to the hands of an incompetent person, with no professional standing, as it is ridiculous to see that person and his advisers gravely speculating how long a current must pass through a person to produce "instantaneous death."

The week set for the execution of Kemmler has passed, and he, therefore, cannot be executed without being recondemned. Thursday of last week a bill passed the Assembly prohibiting capital punishment. It is very probable that the bill will pass the Senate, and it is very possible that electrical execution will never be put into practice.

CORRESPONDENCE.

Electrical Happenings in Boston, Chicago, Washington and Albany.

OUR WASHINGTON LETTER.

The Life Saving Bureau has completed arrangements and purchased supplies for the construction of a telephone line along the southern and eastern coast of Cape Cod, to connect all the life saving stations in that vicinity, from Race Point and Provincetown to Monomoy. The line will be built of No. 9, B. W. G. wire, on cedar poles, 20 feet long, and will connect with the lines of the Old Colony Railroad, for communication with the outside world. It will be finished in the early summer.

The Washington and Georgetown Street Railway is prosecuting its experiments with the storage battery car with marked success, which gives reason for the belief that this motive power may be permanently employed on the road. All the work has been done privately and with a determination to make no public announcement until the officers of the company were fully satisfied with the result of the experiment. The car is usually run over the road between 2 and 5 A. M., and, so far, nothing has been encountered on the line that the car was not equal to.

The Main Features of the Wheeless electric railway invention, as modified since last described in the REVIEW, and as now exhibited, consist of a heavily insulated cable, leading from the dynamo, buried in the ground between the tracks, and connected, in iron boxes placed at intervals of 300 feet, with a peculiar arrangement of electro-magnets and contact breakers. The electro-magnets are operated by a primary battery current conductor from the car, through the wheels and the track, and are so arranged that, when the car is on any given section of 300 feet, the dynamo current is carried to the trolley wire, which is laid in a small conduit just below the surface of the ground, and is divided into sections extending from one box to the next. In the experimental plant now in operation, the trolley wire is laid in an open groove in a strip of wood with a space of about one inch between the sections. The inventor proposes, however, to use a covered conduit, in which the wire will not be so much exposed to the weather. The advantage claimed for this system, over overhead wire systems, is that only a small portion of the trolley line will be in use at one time, and that, therefore, the escape of current and loss of power will be proportionately less. A syndicate is selling stock and arranging to organize a company to exploit the business. H. M. Baker, No. 1411 F street, is the managing man of the syndicate.

The Commissioners of the District of Columbia are arranging a plan for making systematic and thorough photometric tests of the electric lights furnished for public use in Washington, for the purpose of determining whether the lights really come up to the required standard of 1,000 candle-power. There is no particular reason for believing that they do not meet the requirements, but the matter is regarded in the same light as any other case in which the authorities measure goods received before they pay for them. Captain Lusk, who has charge of electric affairs, is consulting with Captain John Millis, of the Lighthouse Board, in regard to the details of the tests to be made.

Visitors.—A large delegation of city officials, street railroad men and other interested persons from Chester, Pa., visited Washington last week and spent two days in investigating the electric roads in that place. They paid especial attention to the Thomson-Houston overhead lines, with a view of deciding whether it would be advisable to permit the erection of similar poles and wires in Chester. Like everybody else who has examined the New York avenue line of the Eckington Road, they could find no objection to its appearance.

The Long Distance Telephone Line has reached Washington, and is in successful operation. Communication with New York and Boston is carried on with perfect ease and in the most matter of fact manner. The lines will be formally opened for general public use next week.

Electrocution.—The anticipated departure of Mr. Kemmler gave rise to a good deal of interest and discussion among prominent government officials who are connected with electrical affairs, and, if the event had not been postponed, it is likely a very able, scientific electrician, representing the government, would have been in attendance to observe and record the exact conditions and results of the experiment. It is believed that the data which could have been obtained would be of much value in many ways. The medical departments are giving much study to the effects of electricity as a curative agent, and are particularly interested in knowing what the limit of safety is. Exact information regarding the power of a fatal current would have an important bearing on this question. Officers in charge of electric light and power apparatus are also interested. In addition to these, the Census Bureau will probably be compelled to take some notice of electrocution (if any criminals should be electrocuted before its work is completed), and there are numerous reasons why a correct record should be made by some competent, unbiased person.

The Glen Echo Railway Company, which will extend from the terminus of the Georgetown and Tennallytown Road into Maryland, is about ready to make contracts for constructing the tracks and the electric equipment. The Thomson-Houston and the Sprague Companies are bidders for the latter.

Washington, D. C., May 3. G. C. M.

OUR BOSTON LETTER.

The Brown Electric Protector Company, of Philadelphia, has established an office at No. 54 Devonshire street, this city, with Messrs. Smith, Johnson & Daskam, as New England agents.

Messrs. Claflin & Kimball, Boston agents of the Mather Electric Company, are installing a 350 light (incandescent) isolated plant in the mammoth building of Messrs. Shapleigh & Company, on Kingston street, this city.

Removal.—The New England office of the "C. & C." Electric Motor Company has been removed to No. 63 Oliver street, this city.

The Edison Illuminating Company, of this city, has closed contracts this week for upwards of 500 incandescent lights, among the wealthy property holders on Commonwealth avenue and Beacon street.

Messrs. Pettengell, Andrews & Company, of this city, the widely known electrical supply house, report the outlook for a healthy spring and summer trade as very encouraging. Mr. Pettengell is at present making a trip among his firm's customers in Northern New England, and every mail brings the Messrs. Andrews new orders to fill.

The Russell Electric Lamp Company, manufacturers of a new arc lamp, No. 85 Water street, this city, have secured a very satisfactory testimonial from the Boston board of underwriters, in which is stated "there can be no objection to its use on any arc current in the city of Boston."

The New England Electric Safety Company has purchased from the United States Electric Safety Company (parent company), of New York, exclusive rights to sell the Crandall Electric Protector in all the New England States. The company has established itself in commodious quarters at No. 146 Franklin street, under the management of Mr. E. E. Zimmerman.

Mr. Frank Harrington, of the Tropical American Telephone Company's New York branch, was in this city the early part of the week. He reports the business of his company's New York department as being brisk and very satisfactory, and that scarcely a day goes by without orders for telephones being received from either South America or Central America.

The Waltham Electric Light Company's station is being enlarged, and the lighting capacity nearly doubled. A new compound condensing engine, from the works of the Armington & Sim's Engine Company, has been added to the steam plant, and two large generators have been installed among the electrical equipment. This station has made the necessary arrangements to furnish electric power for propulsion of the electric cars to run between Waltham and West Newton. It is said that the road will be in operation by May 15.

The Jordan Train Signal Company, of this city, has purchased, it is said, a large interest in the Duralite Manufacturing Company, and have perfected arrangements by which the former will hereafter manufacture and sell the insulating fibre product of the latter. The Jordan Company will continue to manufacture its electric signaling devices and apparatus for railway use. The company has taken offices with the Duralite Company, at No. 85 Water street.

Electric Lights for Boston City Hall.—At a meeting of the common council, of this city, on Thursday, April 24, the council concurred with the previous action of the board of aldermen on the following order:

That the joint special committee on electric light plant for city hall be authorized to report estimates for furnishing and establishing an electric light plant in the basement of city hall, for lighting city hall, the court house in Court square, and the registery of deeds building.

Also, an order was presented providing for a visit to New York city and Philadelphia, in order that electric lighting plants there may be examined, with a view of introducing one into the Boston city hall, discussed at length, and finally passed.

Electric Stocks.—Boston quotations at closing hour of the Exchange, Saturday, May 3, were as follows:

Thomson-Houston Electric Company	55⅛
" " " " Preferred.	25⅜
" " " " Series C..	17.
" " " " Series D .	7⅜
Thomson Electric Welding Co	225.
" European Welding Co	123¼
Westinghouse Electric Co	43¾
Fort Wayne Electric Co	141.
Lynn Gas and Electric Co	150.
Edison Phonograph Doll Co	6.
TELEPHONE:	
American Bell	222.
Erie	41¾
New England	50.
Mexican	.95
Tropical American	.95
National Tel. Mfg. Co. (acoustic)	.60

Boston, May 3, 1890. W. I. B.

OUR CHICAGO LETTER.

City Plant.—The new city electric light plant at Rice and Lincoln streets, in the northwestern part of the city, is nearly completed and it is expected to operate the lights, 104 in number, for the first time May 26th.

The Central Electric Company have secured the general western agency of the Burnley Dry Battery.

Removal.—Ernest L. Clark and Ernest Hoefer have removed their office to 341 Rookery.

The Strike.—Owing to the strike among the carpenters, now on in Chicago, the building which was being fitted up for the Mather Electric Company, on Canal street, is in the same condition as when the company decided to move to new quarters. As the lease of their old office expired on May 1st, they were obliged to seek other quarters, and have rented a suite of rooms in the same building, occupying Room 9, instead of 11.

Personal.—Mr. Hahn, of the Perkins Lamp Company, is spending a few days in the city. Frank Rae, of the Detroit Electrical Works, is visiting in Chicago.

The New Electric Light Stations lately started by the city are, at this writing, operating 520 arc lights. The Chicago Avenue Station, located at Chicago avenue and Sedgwick street, has a boiler capacity of 500 horse-power and is operating at present 190 lights. Eight 35 light Thomson-Houston arc machines are in use, power being furnished by four 125 horse power Ideal engines. The main building is of brick, 85x50 feet. This plant was started February 22d, 1890.

The Troop Street Station, at Troop and Congress streets, was started March 17th, 1890, and is operating 330 arc lights. The Western Electric System is used at this plant. Fourteen 30 light machines and six 35 light machines are set up in the station, although all are not in use at present. The Ideal engine is also used at this plant, there being five 150 horse-power engines now in use, each engine being belted to four machines.

At Milwaukee articles of incorporation of the National Home and North Greenfield Company were filed with the register of deeds on Thursday. The company was formed for the purpose of manufacturing and operating an electric street railway from points near the Northeastern and Union depots to the railroad station at North Greenfield, a distance of about 10 miles. The capital stock of the company is placed at $100,000. The following gentlemen are interested: Paul Bechtner, Hugo Lorenbach, Wm. D. Gray, G. M. Hinkley, Henry Moore, T. W. Henderson, of Milwaukee; and Chas. L. Dana, of the town of Greenfield.

Legal News.—A number of electric light suits are in the courts in the above city. Some time ago, the city council ordered the Milwaukee Electric Light Company, who are operating under the Milwaukee Telegraph Company's franchise, to put up lights at several points in the city. S. S. Badger, of the Badger Illuminating Company, maintains that such an act is a violation of the contracts with the city, and threatens to put up the lights. D. B. D.

May 1, 1890.

OUR ALBANY LETTER.

April 28.—The Senate passed Senator Laughlin's bill, providing that telegraph and telephone companies need not file their mortgages as chattel mortgages.

The Albany Railway began running electric cars on its State street and West Albany line. The cars go up the steep State street hill very satisfactorily, and are generally voted a great success.

April 29.—The Senate advanced to third reading Senator Laughlin's bill, allowing gas companies to furnish electricity. The Assembly passed Assemblyman Larmin's bill allowing village electric light companies to run electric railways.

May 1.—In the Assembly, Assemblyman Curtis' bill, abolishing capital punishment, came up on final passage. Mr. Hitt spoke of capital punishment as a relic of barbarism. Those favoring advanced civilization should vote for the bill. Mr. Tompkins earnestly favored the bill. Mr. Blumenthal thought imprisonment for life a heavy enough punishment. Perhaps it is right that only the Lord above shall determine the time a man's life shall end. The bill passed, 75 to 29. When it went into the Senate Mr. Saxton tried to have it advanced to a third reading, but Mr. Canda objected, and it was sent to the judiciary committee.

The Assembly passed Mr. Weed's bill for lighting Flatbush with electricity.

May 2.—The Senate passed Senator Laughlin's bill, authorizing water companies to furnish electricity, and Assemblyman Larmin's allowing village electric light companies to operate electric railways. Senator Chase introduced a bill authorizing the hearing of the claims of the United States Electric Light Company, which furnished electrical apparatus for a portion of the capitol.

In the Assembly, Mr. Curtis announced that the New York newspapers had contained some maliciously false statements. The intimations that the members who had voted for his bill abolishing the death penalty, did so at the instance of any corporation, were utterly false and unfounded.

Albany, May 3, 1890. H. L.

An Austrian Firm Sues the Edison Company.

A bill in equity was filed last Saturday in the Circuit Court of the United States, by Ganz & Company, through their counsel, J. Edward Ackley and Roger Foster, against the Edison Electric Light Company. The plaintiffs are an Austrian corporation, with their principal place of business at Buda-Pesth, in Hungary. They allege that they are the owners of certain valuable inventions for the distribution of electricity by means of alternating currents, through the Zipernowski, Deri and Blathy system; that, in 1886, the Edison Electric Light Company, through agent Francis R. Upton, represented to them that the Edison Company desired to introduce the plaintiffs' system in the United States, and would spend a large amount of capital in pushing it, provided they could obtain an exclusive right on sufficiently favorable terms, and that the plaintiffs sold the light company an option to purchase their patents.

The bill further alleges that upon the conclusion of this contract, which prevented the plaintiffs from allowing other corporations to use their system, the Edison Electric Light Company began to discredit in every way possible the distribution of electricity through alternating currents. Instead of assisting Ganz & Company, it is claimed that the Edison Company acted against the Hungarian Company, and filed interferences or assisted others who had filed interferences, and did all that was possible to prevent the establishment of the rights of Ganz & Company.

The bill, which is sworn to by Dr. George H. Benjamin, as agent for the plaintiffs, prays for a decree ordering a cancellation of the contract, and for damages. The plaintiffs believe their losses have amounted to $500,000. A subpœna was issued directing the defendants to appear and answer the bill on or before the first Monday in June, 1890.

A Removal.

The Brooklyn plant of the Fort Wayne Jenney Electric Company, will be removed in September to Fort Wayne, Ind., where the manufacture of the Wood apparatus will be carried on, on an extensive scale. This will make quite a boom for Fort Wayne, as about 250 workmen and their families will move with the plant.

PERSONAL.

T. F. Clohesy, of Kansas City, was a metropolitan visitor last week, and favored the REVIEW with a call.

Wm. Hazelton, 3d, of Philadelphia, stopped in the city a short time last week, and was a welcome visitor at the REVIEW office.

Prof. Robert Spice has been obliged, on account of other work, to sever his connection with the Brooklyn Institute, his lecture on Saturday evening, May 3d, concluding his duties. The electrical department has prospered under his able administration as president, having now a membership of over 180. Prof. Spice's course of lectures on "Electrical Measurements," have been of great value to all.

General O. E. Madden, president of the Electric Club, of this city, writes to a correspondent that he is enjoying his European tour immensely, and expects to be greatly benefited in health by it. The middle of April was spent in Rome, and from there the General expected to go to Naples, Pompeii, Mt. Vesuvius, etc., returning through Germany and Austria. A later letter states that he will spend a few weeks in Carlsbad.

Messrs. Chadbourne, Hazelton & Co., formerly general agents of the Sprague Motor Company, of New York, for Pennsylvania, Delaware, Maryland and Southern New Jersey, have severed their connection with that company, and have made arrangements with the Wenstrom Consolidated Dynamo and Motor Company, of Baltimore City, as sole selling agents for the United States. The Equitable Electric Railway Construction Company, Mr. A. H. Chadbourne, president, Mr. Wm. Hazelton, 3d, secretary and treasurer, and Mr. W. A. Stadelman, chief engineer, will continue to transact their general construction business for railways and isolated plants, for both lighting and power purposes.

Telephonic News

⁂ "Bell Telephone, now that its stock advances on the new issue, is talked for $250. Its friends say its cash dividends and future rights give it this value."

⁂ The Ohio Legislature adjourned last week without enacting any telephone legislation. The telephone rate bill introduced did not receive favorable consideration.

⁂ During the three months ended March 31, the subscribers to the Erie Telephone Company increased 250, and the aggregate number is now 12,245. The increase for the fiscal year was 930.

⁂ A new telephone has been brought out in England which is said not to infringe on any existing patent. It is of the most simple construction, consisting of an electro-magnet and celluloid diaphragm.

⁂ The telephone exchange at St. Paul, owned by the Erie Telephone Company, moved into its new quarters last week, and is operating with a new multiple switch-board, requiring the services of 15 operators, as against 27 under the old arrangement.

⁂ A game of whist by telephone has been arranged by general superintendent Hibbard, of the American Telegraph and Telephone Company. The game will be played over the line between Morristown, N. J., and Easton, Pa.

⁂ The court of common pleas, at New Haven, Conn., has been engaged in trying a case against the Southern New England Telephone Company, involving the duty of the defendant in performing service for the public—a case that is regarded very much in the light of a test case. E. A. Saunders, of Naugatuck, sues the company for $100 damages for delay in transmitting a message. It is alleged that the plaintiff, in July, 1888, tried to call a Waterbury doctor to attend a member of his family who was very ill; that there was delay of three-quarters of an hour in securing telephone communication, and that the delay was due to the carelessness or neglect of the defendant. In the meantime the illness of the patient was aggravated by the delay and the physical suffering enhanced, and was great injury to the feelings of the plaintiff. According to the testimony, the plaintiff had a member of his family and two servants very ill at the time. Two of the patients were in great pain, and there was need of securing a physician at once. He called by telephone to connect with Dr. Meyers at 8 in the evening. The reply came, the doctor did not answer. Half an hour later Mr. Saunders called again, and when he began to talk, his communication was suddenly cut off. After delay of another half hour he succeeded in getting Dr. Spring by telephone, who came out to attend the family. It seems that during the waiting, some rather uncomplimentary words were exchanged. First the operator in the Waterbury office would call the plaintiff a liar, and the response would come, "You're a gentleman." At another time Mr. Saunders heard the operators laughing in the central office. The defendants claim that they were unusually busy in the office at the time of the call, but communication was furnished as quickly as possible. Judge Deming, in his charge, stated that the law of common carriers would apply to this case.

A New Telephone Exchange for Kansas City.

The Missouri and Kansas Telephone Company has determined to remove from its present quarters to quarters that are adapted to its present increased business. With the 2,606 instruments now in use, the facilities for accommodation of any new subscribers are now exhausted.

Whether to purchase property of its own and erect thereon a fire proof building or to lease for a long term a fire proof building to be erected for the company, are questions not yet settled, but they will be within about 60 days. In the new building it is proposed to put the shops along with the business offices and the operating department of the company. The basement and the upper portion of the building will be occupied by the company. This would leave some of the buildings to be rented to others.

The business will be conducted on the single exchange system, with places for about 4,000 instruments, and will be possibly the largest single exchange in the world. It is now the second largest. One in New York is larger, and the sub-station system is there also employed. The company has also determined to use the underground conduit system, instead of the overhead conductors now in use. The lines down town will be taken down without any coercion on the part of the city, and the underground system will take the place of the present one. These changes, it is expected, will be made within a year.

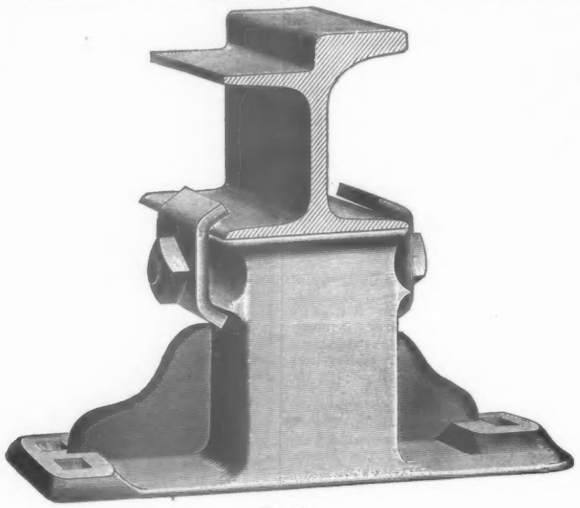


FIG. 1.

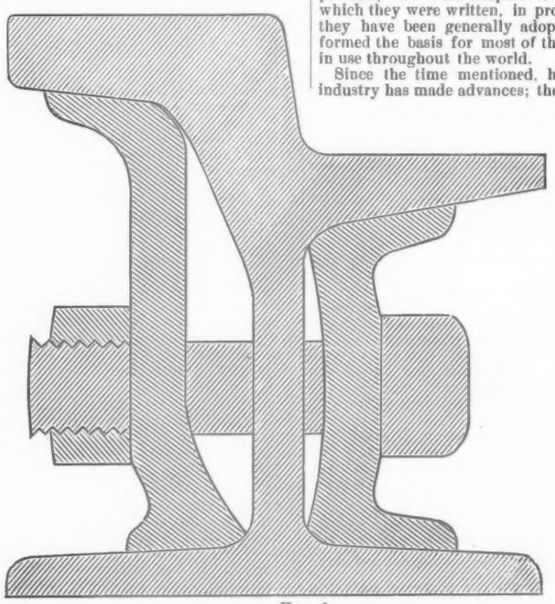


FIG. 2.

Street Railway Materials.

The illustrations presented herewith show, in Fig. 1, a street railway chair, and in Fig. 2, a side-bearing girder rail, both the inventions of R. T. White, Boston, Mass. The chair shown in Fig. 1 is four inches high, and made of cast iron or cast steel mixture. The clamps are of wrought steel, and the bolt passes clear through the standard of the chair. Fig. 2 shows a section of the side-bearing girder rail. The base is equal to the width on top, thus preventing tipping or rolling of the rail. It also prevents the pavement, when settling, from dropping under the head and flange of the rail. The two fish plates, which support both head and flange, prevent the rail giving in the least.

RULES FOR ELECTRICAL WORK.

COMPILED BY DR. GEO. H. BENJAMIN, OF NEW YORK, FOR USE IN ELECTRIC LIGHTING, TRANSMISSON OF POWER, TELEGRAPHY, TELEPHONY AND SIGNALING.

The following rules, which we publish in full, have just been issued in pamphlet form by Dr. Geo. H. Benjamin, the well-known electrical engineer of this city, and will be of especial interest at the present time.

In his introduction, Dr. Benjamin says:

In November of 1886, I prepared a series of rules for the proper handling of electric currents used in electric lighting and the transmission of power. These rules were submitted to the Electric Club, of the City of New York, accompanied by a paper in which I pointed out the fact that the rules controlling the methods of wiring, etc., employed at that date were totally inadequate to protect human life or prevent the occurrence of fires.

The rules which I submitted, and which accompanied my paper, I made as full as possible, and were adapted to the time at which they were written, in proof of which they have been generally adopted or have formed the basis for most of the rules now in use throughout the world.

Since the time mentioned, however, the industry has made advances; the alternating current has been extensively introduced, and it has become necessary to modify the rules in many particulars, as well as to add to them. In order to meet this changed condition, as also to satisfy the demands which have been made upon me for copies of these rules, I have entirely rewritten them and brought them up to date. As they now stand, they are believed to be fair and not imposing any conditions which are either onerous or impossible to carry out.

In my compilation of these rules I have carefully considered all the rules promulgated by the various Institutes of Electrical Engineers, Boards of Trade, Fire Underwriters, etc., of the world, and have endeavored to select and put the applicable rules in such shape as to be readily accessible and capable of being understood.

DEFINITIONS.

For the purposes of the rules the following definitions are given:

Conductor means an electric line or wire used to convey electric energy.

Aerial conductor means a conductor which is placed above ground and in the open air.

Underground conductor means a conductor which is placed below the street level, either in a cable or in a subway.

Main line conductor means either aerial or underground conductors through which current is conveyed from a generating station to the premises of consumers.

Consumer's circuit means conductors on consumer's premises

The expression, Suppliers, means the person or company supplying the electric energy in the form of current.

The expression, Consumer, means the individual or company using the electric energy delivered by the suppliers.

POTENTIAL OF CURRENT WHICH MAY BE SUPPLIED FOR COMMERCIAL PURPOSES.

The currents of electricity which may be employed for commercial purposes may be classified under four headings:

1st. Low pressure supply.
2d. Medium pressure supply.
3d. High pressure supply.
4th. Extra high pressure supply.

These terms are used as referring to the difference of potential between the two conductors, through which the current is transmitted, or between any part of either conductor and the earth; a difference of potential on any alternating system being considered as the same as a difference of potential on a continuous current system, when the said difference in either system produces an equal heating effect, when applied to the ends of a thin stretched wire or carbon filament.

Low pressure supply means a current having an electro-motive force not exceeding 250 volts.

Medium pressure supply means a current having an electro-motive force not exceeding 500 volts.

High pressure supply means a current having an electro-motive force not exceeding 3,000 volts.

Extra high pressure supply means a current having an electro-motive force exceeding 3,000 volts,

REGULATIONS FOR SUPPLY.

RULE 1.—The current which may be delivered or used upon a consumer's premises for incandescent lighting shall not exceed the limit of low pressure supply.

RULE 2.—The current which may be delivered or used upon a consumer's premises for arc lighting or power purposes shall not exceed the limit of medium pressure supply.

RULE 3.—A high pressure current shall not be delivered to the terminals of a consumer's circuit except for special purposes, and with the approval of the proper authorities, on the joint application of the consumer and the supplier, and subject to such further regulations as the authorities may, from time to time, prescribe.

RULE 4.—An extra high pressure current shall not be delivered, except to distributing stations (*i. e.*, transforming stations), or to other premises in the sole occupation of the suppliers, and with the written consent of the authorities, and subject to such conditions as may be prescribed.

RULE 5.—The suppliers shall provide and fix, to the satisfaction of the authorities, such appliances or apparatus as may, from time to time, be considered advisable, whether for safety, for the prevention of the limits of difference of potential or excessive quantity currents as above stated, or for such other limits as may, from time to time, be fixed by the proper authorities in place thereof, either generally or in particular cases, from being exceeded, and sealed patterns of any such appliances or apparatus shall be deposited at the office of the local authority.

RULE 6.—The maximum working current in any conductor used in connection with the supply of energy shall not be sufficient to raise the temperature of the conductor in any part to such an extent as to materially alter the physical condition or specific resistance of the insulating covering, if any, or in any case to raise such temperature to a greater extent than 15 degrees of Fahrenheit's thermometer, and efficient automatic means shall be provided which shall render it impossible for this maximum working current to be by any accident exceeded to the extent of 100 per cent., even for short intervals of time; and special care shall be taken that the cross-sectional area and conductivity at joints are sufficient to avoid local heating, and that the joints are protected against corrosion.

INSULATION.

RULE 7.—The material used for insulating any aerial conductor must be such as will not be liable to injurious change of physical structure or condition, when exposed to any temperature between the limits of ten degrees below zero, Fahrenheit, and 150 degrees Fahrenheit, and to contact with the ordinary

atmosphere of towns or manufacturing districts.

RULE 8.—Conductors used for aerial supply at medium, high and extra high pressure, must be continuously insulated with a durable and efficient material, to be approved by the proper authorities; and the insulation resistance, including joints, shall, when new, not be below 30 megohms per mile, and shall not be permitted to fall, even in stormy weather, below one-fifth of a megohm per mile per 1,000 volts, provided, where medium pressure supply is employed for the operation of street motors, the conductors conveying the supply, and over which the trolley conductors roll, need not be so insulated.

RULE 9.—Conductors used for underground supply between the suppliers' and the consumer's premises at any pressure must be continuously insulated with a durable and efficient material to be approved by the proper authorities, and the insulation resistance of any such conductor, including joints, should not be permitted to fall below three megohms per mile per 100 volts, and the insulation of the whole circuit of which said conductor forms a part, including the apparatus contained therein, shall in no case be permitted to fall below one megohm per mile per 100 volts. This insulation must be further efficiently protected on the outside against removal by abrasion, and should be such that if the potential of the circuit be raised to 1,000 volts above that of the earth, and any portion of the insulating covering of any conductor in the circuit be connected to earth, the leakage current, when tested by a current at uniform pressure in one direction, shall not exceed one-fiftieth of an ampere. Every such circuit should preferably be provided with an indicating device which shall continuously indicate if the insulation resistance of either conductor fall below the conditions required by this regulation.

RULE 10.—Conductors used for underground supply at medium, high or extra high pressure, shall be either separately or collectively completely enclosed in metallic sheathings or casings—if of lead, not less than $\frac{1}{16}$ of an inch in thickness—placed in efficient connection with the earth, either throughout their length, or at points not separated from each other by more than 100 yards.

RULE 11.—All conductors used in buildings should be thoroughly well insulated with a non-absorbant, water proof material or materials, as non-inflammable as possible, and which will not fray or become loose, or melt or become plastic at a low pressure—below 150 degrees Fahrenheit.

RULE 12.—The insulation resistance of cables or conductors should always be determined before such cables or conductors are erected or laid; all lines should be tested for insulation resistance immediately after any new connection with, addition to, or repairs or alteration of any sort, in such conductor or cable is made, and also in the case of underground conduits when any other conductor or cable is placed in proximity thereto.

AERIAL CONDUCTORS.

RULE 13.—An aerial conductor in any street shall not, in any part thereof, be at a less height from the ground than 20 feet, or where it crosses a street, 30 feet, or within six feet of any building, except for the purpose of supply.

RULE 14.—Every aerial conductor shall be attached to supports at intervals not exceeding 200 feet where the direction of the conductor is straight, or 150 feet where the direction is curved, or where the conductor makes a horizontal angle at the point of support.

RULE 15.—Where any conductor crosses a street, the angle between such conductor and the direction of the street at the place of such crossing shall not be less than 60 degrees, and the spans shall be as short as possible. All conductors used for light and power should, preferably, be located and arranged to cross in a higher plane than that of every other aerial conductor or suspended wire used for other purposes; and precautions should be taken (by guard wires, etc.) by the owners of such electric light and power conductors against the possibility of their conductors coming into contact with the other wires, by breakage or otherwise.

RULE 16.—Every aerial uninsulated conductor employed for conveying medium pressure currents for use with electric street railway motors in cities where the earth or the rails are used as the return path for the current to the generators, must have a guard wire arranged over them or be otherwise efficiently protected against the possibility of a falling wire coming into contact with them.

RULE 17.—Every support of aerial conductors shall be of a durable material, and properly stayed against forces due to wind pressure, change of direction of the conductors, or unequal lengths of span, and the conductors and suspending wires (if any) must be securely attached to insulators fixed to the supports. The factor of safety for the suspended wires shall be at least six, and for all other parts of the structure at least 12, taking the maximum possible wind pressure at 50 pounds to the square foot. No addition need be made for a possible accumulation of snow.

RULE 18.—Every support, if of metal (pattern to be determined by the authorities), shall be efficiently connected to earth, and if of wood or other non-conducting material, shall be protected from lightning by a lightning conductor fastened to the support along its length, and projecting above the support to a height of at least six inches, said lightning conductor being efficiently connected to earth.

RULE 19.—A support shall be efficiently connected to earth when it is connected to metallic mains for water supply outside of buildings, or where these are not available, to a mass of metal having a total surface of at least four square feet, buried to a depth of at least three feet in moist earth, provided that in either case the connecting conductor must possess a mechanical strength and offer a passage to electrical discharges equal to that of a strand of seven No. 16 galvanized iron wires.

RULE 20.—Every aerial conductor shall be protected by efficient lightning protectors of pattern approved by the proper authorities.

RULE 21.—Every aerial conductor used for high or extra high pressure supply, shall be efficiently suspended by means of non-metallic ligaments to suspending wires, so that the weight of the conductor does not produce in it any sensible stress in the direction of its length, and the insulating conductors and suspending wires, where attached to supports, shall be in contact only with material of highly insulating quality, and shall be so attached and guarded that, in case they break away, it shall not be possible for them to fall away clear of the support.

RULE 23.—All guard wires employed with conductors conveying medium, high or extra high pressure currents, shall, in all cases, be efficiently connected to earth.

RULE 23.—Aerial conductors conveying currents .or electric light and power purposes shall, in no case, be placed nearer than two feet to any other conductor or wires used for other purposes.

RULE 24.—Aerial conductors conveying medium, high or extra high pressure currents, should, in no case, be attached to the same support as that provided for telegraphic, telephonic or signaling conductors.

RULE 25.—Aerial conductors conveying currents for use with telegraphic, telephonic, signaling or similar apparatus, shall, in all cases, be placed parallel to each other. Every circuit used for any of the designated purposes shall, in all cases, be entirely metallic, and no earth circuits will hereafter be allowed in any locality where there is liability to disturbance from the currents conveyed by conductors used for other purposes.

RULE 26.—The owner of every aerial conductor shall be responsible for the efficiency of every support to which such conductor is attached, and every support shall be properly marked with such a mark indicating the ownership of the conductor as the authorities shall approve.

RULE 27.—Every aerial conductor, including its support and all the structural parts and electrical appliances and devices belonging to or connected with such conductor, shall be duly and efficiently supervised and maintained by or on behalf of the owners as regards both electrical and mechanical conditions.

RULE 28.—An aerial conductor shall not be permitted to remain erected after it has ceased to be used, unless the owners of such conductor intend, within a reasonable time, again to take it into use.

RULE 29.—Every aerial conductor shall be placed and used with due regard to electric lines and works from time to time used, or intended to be used, for the purpose of telegraphic communication, or the currents in such electric lines and works, and every reasonable means shall be employed in the placing and use of aerial conductors to prevent injurious affection, whether by induction or otherwise, to any such electric lines or works, or the currents therein.

UNDERGROUND CONDUITS.

RULE 30.—All conduits used as receptacles for conductors shall be formed of durable material, and of ample strength to resist any reasonable pressure due to heavy traffic, or other forces to which they may be subjected.

RULE 31.—All conduits, manholes, drawboxes and the like, must be thoroughly drained to prevent any accumulation of water, and where conduits are laid in streets in which gas mains are also laid, they must be ventilated or otherwise efficiently protected against an accumulation of gas, and their covers so secured that they cannot be opened except by means of a special appliance.

RULE 32.—All conduits, manholes, drawboxes and the like, in which main line conductors are placed, shall be used solely for the accommodation of such conductors. No switches, plugs, transformers or other devices intended to be employed with such conductors, shall be located in any such receptacle for conductors.

RULE 33.—All conductors or cables which are carried through manholes, drawboxes or the like, shall be properly supported therein and shall have affixed to them at every receptacle through which they pass, an indestructible tag on which is the name of the owner of the conductor or cable, and the tension of the current carried thereby.

GENERATING AND DISTRIBUTING STATIONS.

RULE 34.—Generating stations for supplying electric currents for electric light and power should preferably be in the sole occupation of the suppliers, and where such stations are located in thickly settled localities they should in all cases be so constructed as not to be liable to destruction by fire occurring within or without the premises.

RULE 35.—Generating stations from which medium, high or extra high pressure currents are supplied, should have the apparatus therein so located as not to be accessible to any one not employed within the building, the main switchboards of such stations should be absolutely fire proof, and all conductors as well as all the metallic parts of switches and other apparatus which may be insulated, so insulated as to prevent any possible danger from accidental contact. A danger sign should, in all cases, be affixed in a prominent position on such switchboards.

Distributing stations to which a high or extra high pressure current is given from generating stations, and from which a low pressure current is given to consumers, must be established on suitable premises in the sole occupation of the suppliers, and the current from such stations must be constantly controlled by a skilled person in the service of the suppliers, and printed directions must be conspicuously exhibited in every station, providing for the action to be taken by such person in charge in any emergency, the occurrence of which may be reasonably considered possible; and these directions shall be submitted for the approval of the proper authorities.

RULE 36.—In every case where the supply is transformed at a distributing station, as described in the preceding regulation, means must be provided to the satisfaction of the proper authorities, which shall render it impossible that the low pressure mains shall be at any time charged to a dangerous difference of potential to the earth, owing to any accidental contact with the high pressure system, either within or outside the distributing station.

INSTALLATIONS FOR ELECTRIC LIGHT AND POWER IN BUILDINGS.

RULE 37.—No naked conductor or conductors allowed in a building.

RULE 38.—All light and power circuits must be entirely metallic and of properly insulated wire. The employment of gas, water or steam pipes, or the earth, as a part of the circuit is positively prohibited.

RULE 39.—Where practicable, all conductors in a building should be so placed as to be easily accessible for repairs or inspection, but not easily accessible to the ordinary user. The location of all concealed conductors should be plainly designated by an appropriate mark.

RULE 40.—No conductor, whether bare or insulated, shall be laid in wet cement, plaster, mortar or other similar wet material.

RULE 41.—All conductors not provided with a metallic sheathing and carried through or between walls, floors or partitions, or otherwise out of sight, must be enclosed in separate earthenware, terra cotta or asbestos board tubes, or their equivalent. Conductors provided with a metallic sheathing may be carried in pipes made of the materials mentioned, and also in metallic pipes, in which case both the metallic sheathing of the conductors and enclosing pipes must be efficiently connected to earth. All enclosing pipes should be of slightly larger interior diameter than the conductors they are designed to convey, and so arranged as to drain themselves of any water which may collect in them.

RULE 42.—Conductors should not be placed above each other in such a manner that water can make a cross-connection, and special care should be taken to protect all concealed conductors from mechanical injury.

RULE 43.—Conductors must never pass through party walls separating two risks, unless permission to do so has been given and such permission assented to by the owners of the two risks.

RULE 44.—Single or twin wire insulating conductors may be carried through electroliers or gas fixtures, but special care must be taken to insulate such conductors from the metal parts of the fixtures, which should not be in electrical connection with the earth.

RULE 45.—Twin insulated wire may be employed in branches feeding single incandescent lamps in parallel of the main circuit.

RULE 46.—Conductors conveying low pressure currents that run along walls or other exposed supports, should be placed at least two and one-half inches apart, and a similar distance from all other wires or metallic bodies, except as provided in Rule 51.

RULE 47.—Conductors conveying low pressure currents should preferably be placed in grooved mouldings or casings of wood, dry plaster or like material, arranged along the cornice line, and in such case there should be a septum of insulating material, having a thickness of half an inch, between the conductors. Wooden mouldings should have their covers screwed on, and they may be rendered fire proof by painting them with a solution of tungstate of sodium in water.

RULE 48.—Conductors conveying medium pressure currents should be placed at least six inches apart, except where the conductors are covered by a metallic sheathing, which should be efficiently connected to earth; the same distances should be observed in the case of conducting bodies, and a space of two feet between such conductors and other wires of smaller diameter placed parallel therewith.

RULE 49.—Conductors conveying high pressure currents should always be enclosed in metallic sheathings, connected to earth, and such sheathed conductors, when they enter consumer's premises, should be enclosed in fire proof insulated casings or in metallic tubes connected to earth.

RULE 50.—No metallic staples, hooks or devices for attaching and supporting electrical conductors, should be employed in buildings. Wooden cleats or porcelain saddles must be provided, and which should be so arranged that the supporting screws therefor do not connect with any conducting body.

JOINTS.

RULE 51.—All joints must be made so as to secure perfect and durable contacts, which shall always maintain a degree of conductivity at the joint at least equal to that of the conductor generally. Joints on conductors should be made in such a manner as to be mechanically secured against motion or displacement. The conductivity of the joint may, if desired, be increased by the use of any suitable solder, such as tinners' solder, provided that no corrosive or otherwise injurious substance be employed therewith.

SAFETY FUSES.

RULE 52.—Safety fuses, made of fusible metal, should be provided at both points of junction of a branch circuit with a main circuit, when the conductors of the branch circuit are of such a size that a diversion of the whole current of the main circuit to the branch circuit would increase the temperature of the conductors of the branch circuit above 15 degrees Fahrenheit, as set forth in Rule 6; and the fusible metal used in such safety fuses should be adapted to melt and absolutely break the circuit by such increase of current.

RULE 53.—Safety fuses should be located in the conductors conveying a charging current to a storage battery, and in the conductor from a storage battery to the translating devices. Automatic magnetic cut-outs may be employed in place of fusible strips.

RULE 54.—Safety fuses should be located in both conductors of a circuit employed for telegraphic, telephonic or signaling purposes, at the point where said conductors enter the building. Any automatic cut-out may be employed in place of safety fuses, which will open the circuit should the current transmitted thereon exceed the normal current by 100 per cent.

RULE 55.—Where practicable, all safety fuses for each room or branch from the main circuit should be placed in a conveniently located fire proof box, or mounted upon an incombustible plate, so that they can be inspected or renewed without inconvenience or injury to the premises.

SWITCHES.

RULE 56.—A cut-out switch which can be operated by the firemen or police should, in the case of large buildings, be placed in a conveniently located, moisture proof box on the outside of the building; in smaller buildings this box may be placed inside the building, but as near the entrance as practicable. When the current is supplied from a central station an automatic cut-out should be employed which should act at or below 100 per cent. above the normal current.

RULE 57.—All switches, switchboards, cut-outs, safety fuses, resistance boxes, distributors, regulators, transformers, lamp fixtures and the like, must always be mounted upon a non-combustible insulating base; all switches must be quick in action and preferably arranged to simultaneously make and break at both poles. Lapping and rubbing contacts are to be preferred.

DISTRIBUTOR BOXES.

RULE 58.—Distributor boxes on arc light circuits (multiple-parallel or multiple-series systems) should be of iron, and have all the exposed parts, including the operating handle, formed of the same material and connected to

(Continued on page 10.)

* * The horse car line at Hannibal, Mo., is to be converted into an electric railway. The overhead wire system is to be used.

* * The electric street car system of the Short Electric Railway Company has been tried in Muskegon, and pronounced an unqualified success.

* * The Minneapolis Street Railway Company has decided to have but one power house, and will fit up one adjoining the general offices with a plant capable of generating 3,600 horse-power.

* * The Newton Street Railway Company must complete its electric road by July 1, next. The Thomson-Houston system will be used. The work of relaying the rails between West Newton and Waltham is now in progress.

* * Dr. Dixon, professor of hygiene at the University of Pennsylvania, has been making some experiments with air and dust obtained in street cars. He has found in them the germs of many diseases, contagious and otherwise. Better ventilation and more effective cleansing are sorely needed.

* * The Electric Railway Company, of Asbury Park, will own the largest plant of the kind in New Jersey when the extensive addition is completed. The company is making preparations to add two 80 horse-power boilers, an automatic cut-off engine of 150 horse-power, and a 50 horse power dynamo. It is expected that the machinery will be in working order about the middle of July.

* * The conductors and engineers on the Ottumwa electric street railway have struck vainly for shorter hours and the privilege of smoking while on duty. The latter demand seems rather curious. It indicates on the part of certain citizens of Iowa an appetite which a consistent prohibition State should at once abolish, or order to be abolished by statute and constitutional amendment.—*N. Y. Sun.*

* * In the City Circuit Court recently the charter of the Old Dominion Electric Light and Power Company, at Richmond, Va., was so amended as to give it the power to lease, sell, transfer, etc., its rights, franchises, etc., to the Richmond Railway and Electric Company, or any other company chartered for like purposes. A similar amendment was allowed to the Virginia Electric Light and Power Company.

* * When the Robinson-Foster Motor Company, of Peabody, Mass., was doing business, it supplied a number of motors to different people. The parties who purchased the business under foreclosure have sued the users of these motors to recover for their value. The users claim that the machines were put in on trial, and in one case that the motor was ordered out before the old company suspended. In another case creditors of the old company placed attachments on the motor.

* * "The electric cars," says an Albany physician, "will have a curious effect upon the health of the people who use them. Many people will embrace the opportunity offered by them to take short excursions to the park or to the suburbs, and in this way many old people, invalids and nurses with children, will often take an outing which before they did very seldom. So far it will be beneficial. As to nervous people, I do not anticipate that it will affect them at all. Nervous people will be nervous, whether they travel by canal boat or pony express. It makes no difference. But men who have been in the habit of walking to and from their places of business, even from the termini of the lines, because they could make just as good time, counting waits, as the cars, will now be induced, by the saving of time, to use the cars, and so I anticipate that our profession will have more dyspepsia cases than formerly."

Baxter Electric Motor Company.

A meeting of the board of directors of the Baxter Electric Motor Company, of Baltimore, was held on April 30th, in Baltimore, to arrange for issuing bonds for $100,000, secured by a mortgage upon the company's property. All of the bonds have been placed at par with the Safe Deposit and Trust Company, of Baltimore, as trustee for the bondholders. The mortgage has been made to increase the working capital of the company, which has been doing very well since its reorganization, two months ago, with the following board of directors: Messrs. B. F. Deford, E. G. Hight, B. F. Smith, Cumberland Dugan, A. H. Jackson, Samuel W. Regester, B. F. Bennett, Benson M. Greene and Jesse Hilles. Mr. E. G. Hight is president of the company. There is a general demand for the Baxter motor. Daniel E. Evans is the general superintendent of the works. A meeting of the stockholders of the company was held, and ratified the action of the board of directors.

No Execution by Electricity Just Yet.

A STAY GRANTED IN THE KEMMLER CASE BY JUDGE WALLACE, OF THE U. S. COURT.

As announced in the ELECTRICAL REVIEW last week, it was expected that Kemmler, the wife murderer, would be executed by electricity, at Auburn, N. Y., some time during the week beginning April 28th.

A large number of people had gathered at Auburn, including the gentlemen invited to be present, in accordance with the new law, and a vast number of reporters of the leading dailies of the country. It was arranged that the execution would take place early Wednesday morning, but on Tuesday, Attorney Roger M. Sherman, of this city, procured a writ of *habeas corpus*, returnable June 17th, signed by Judge Wallace, of the U. S. Court. The ground for the writ is that the State law, in providing for execution by this means, is in violation of the Constitution of the United States.

It was a narrow escape for Kemmler. Under the law of the State, which provided for execution by electricity, he could have been executed any time after midnight, Sunday, April 27th, and as it was, the notice of the stay did not reach Warden Durston until Tuesday afternoon, and had been signed the day before by Judge Wallace, in this city. It is pretty freely predicted that the law will be repealed.

In an interview with Warden Durston, he detailed the preparations he had made for the execution of Kemmler before the writ was served upon him. Tuesday morning, at 6.30, the belt was put on the dynamo, and the engine was run several minutes to see if the bearings, pulleys, etc., were in proper order. The machinery was found to be in condition, and it was decided to put the belt on again at 5.30, and keep steam up all night. The story that he had ever intended to go on with the execution on Tuesday morning, was without foundation. His invitations to witnesses did not ask them to report until 9.30 Tuesday evening. He had made up his mind to have the execution occur between that hour and 6.30 Wednesday morning, if the final test proved successful.

A Big Electrical Storm.

The Cunard Line steamship, "Aurania," which arrived in New York from Liverpool last week, had a lively time when about 80 miles off Fire Island.

About 8 o'clock a severe thunder storm came up and the lightning lit up the heavens at short intervals. Suddenly the ship became a mass of liquid fire. The passengers crowded the deck, in spite of the rain which was falling.

For a time considerable excitement was experienced. The electric storm, which Captain Dutton says was the most brilliant he ever saw, lasted until 10 o'clock; then all was utter darkness.

During the time the electricity was playing its fantastic tricks on board the "Aurania," the lightning struck uncomfortably near the vessel several times.

Each individual rope on the ship seemed afire, the blaze being a most brilliant electric blue. No damage, whatever, was done, but the storm and the fright caused many headaches, particularly among the ladies.

The Microbe of the Magnet.

We had supposed all discussion on this interesting subject at an end, and, in fact, had declared our columns closed. But—you see there is a but—a lady has entered the lists, and we make her our most profound respects and with pleasure open the discussion once more. However, as the auctioneer says, this is the "last call":

TO THE EDITOR OF ELECTRICAL REVIEW:

In a number of the ELECTRICAL REVIEW, a writer, under this heading, asks where the energy comes from which feeds the magnet; whether "from gravity, from the atmosphere, from solar rays, or from earth currents? Who can say? It is a great problem, worthy of a lifetime of indefatigable research." Professor Dolbear, in a later number, answers these questions as only one of the "uninitiated" would answer; yet, nothing is more simple than the truth, as to the source of energy in the magnet, to those who are conversant with Mr. Keely's theories and have witnessed his demonstrations. It comes from the polar stream; and, though the introductory impulse is so slight that it cannot be weighed any more than can the flow of the mind, yet, if kept up for years, it could not be computed by billions of tons in its effect. The magnet that lifts 10 pounds to-day, if the load of the armature is gradually increased day by day, will lift double the amount in time. Whence comes this energy? Keely teaches that it comes from sympathetic association with one of the triune currents of the polar stream, and that its energy will increase as long as sympathetic flows last, which is through eternity.

The physicist tells you that "you cannot make something out of nothing;" that "in the *economy* of nature profit and loss must balance;" that "no matter what the nature of the force may be, its production must necessarily be accompanied by a corresponding expenditure of force in some form or other," etc., etc. But, in the *prodigality* of nature, this energy flows, without measure and without price, from the great storehouse of the Infinite, from the sympathetic portion of the etheric field, where all visible aggregations of matter emanate, and on the same order that molecular masses of all living organisms are vitalized by the sympathetic flow from the brain.

In opposition to Dolbear, Keely would contend that a force or flow of sympathy, exerted to carry a load indefinitely, whether the load it carries is in motion, or entirely quiescent, is the same substantially in the one as in the other. The mere fact of the magnet carrying its load proves conclusively the constant flow or positive action of a sympathetic force, the velocity exceeding millions of vibrations per second.

The professor, in his answer, institutes a comparison equivalent to hanging a weight on a hook, which would make the polar magnetic flow and the suspension of the weight on the hook about one and the same thing, as regards the principle that holds them together, as if a dead body, after decapitation were held to its head by a hook and that, under such condition, the sympathetic flow which exists during life, between the head and the body, continued to pass from the brain through the hook to the body, controlling its movements as in life. This is not sound philosophy. Philosophic knowledge, in the widest acceptation of the term, is the knowledge of effects as dependent on their causes. It has been defined as the science of first principles, the science of causes. Wilcox defines science as a series of systemized reasonings deduced from facts or from other reasonings through premises furnished by evidence or authority; and going back to self-evident metaphysical truths as fundamental knowledge. But what knowledge have we? We know very little, if anything, of first causes; therefore, we have no sure basis for knowledge; and, consequently, very little true philosophy; very little true science. If, as Buckle asserts, the laws of nature have their sole seat, origin and foundation, in the human mind, then the highest of our so-called science has never had a sure foundation on which to build the edifice of pure philosophy. Our most learned men know not what magnetism is, nor electricity, nor gravity, nor cohesion, nor force. Keely, the discoverer of etheric force, and of the means of overcoming gravity, is the first man whose discovery is connected with the laws of mental science. He tells us that gravity is a certain form of etheric vibration; that electricity is a certain form of atomic vibration; that cohesive force is, like gravity, an ever existing force of sympathetic negative attraction, holding together all molecular masses, and that were the vibrating velocity of this attractive force to cease for one moment, all aggregations of matter that exist in nature would fall apart and pass back into the ether.

If Professor Dolbear's reasoning were carried out, down to molecules, we might expect to find them held together, in their different forms of invisible matter, by hooks instead of by sympathetic association or links of sympathy. Such seems to be the philosophic range in his answer to the true wisdom in the reasoning of the one who wrote the article on the source of the energy in the magnet.

London, Eng. CLARA JESSUP MOORE.

The Patent Office.

The discussion in the House of Representatives, a few days since, on a proposition to increase the salaries of the principal examiners in the Patent Office from $2,400 to $2,500, brought out some peculiar opinions. Congressman Butterworth, who was formerly commissioner of patents, and who is entirely familiar with the work and the needs of the office, said "they pass upon questions involving millions of dollars. We want men of ability and integrity, who are competent to dispatch the business brought before them. Their compensation is inadequate, and it is next to impossible to keep good men there because of the reduced salary."

Congressman Washington, a farmer, of Cedar Hill, Tenn., said, "patent attorneys in this city employ clerks at from $10 to $15 per week, who possess the same amount of skill, knowledge and judgment, as that exercised by these examiners. Among the latter there are many broken down politicians, preachers and others, who are held in office by virtue of their having friends in the Church and the State. The decision of a principal examiner amounts to nothing more than an authority to go into court and test the validity of a patent and the priority of an invention."

Congressman Buchanan, a lawyer, of Trenton, N. J., said: "I repudiate the characterization of these examiners. They are experts and strong men, and they should receive the full amount of salary proposed by the bill."

Congressman Tillman, a cotton planter, of Clarks Hill, S. C., said: "The chief business of the principal examiners is simply to pass every patent. None of them dare refuse to grant many patents, no matter how frivolous they are. The patent attorneys would soon hound him out of office for curtailing their fees."

Congressman Simonds, lecturer on patent law, at Yale College, said: "There is no kind of duty that has more of judicial functions in its nature than the duties performed by the examiners in the Patent Office. They have to examine into the state of the art, as to questions pending before them, including patents in this and foreign countries, and including all the literature of the civilized world which treats upon the subject, and in the light of the information thus gained, to determine whether a certain application before them presents, in their judgment, novel features, and an improvement which is, within the law, patentable. These examiners rank far above the average of the employés in the other departments of the government."

GENERAL ELECTRICAL NOTES.

On May Day, this city was treated to a severe thunder storm. Flag poles and sparrows were the chief sufferers, however.

Warden Osborne is to have a system of electric bells put up in the Tombs, by means of which signals can be given in all parts of the prison.

The Valley Gas Company, of Wellsville, Ohio, has increased its capital stock to $45,000, for the purpose of erecting an electric light plant in addition to their gas plant.

In the United States Circuit Court, last week, Judge Wallace entered an order allowing Edison to amend his bill of complaint in the phonograph suit. The court gives the defendants until June to file their answer.

Mr. C. R. Barney, of Providence, R. I., the father of Gen. C. H. Barney, of New York, has been visiting this city during the past week. The gentleman is now 74 years of age, and his last visit to New York was in 1839, at which time, as he remembers, the city was quite compactly built up as far north as Fourteenth street. As a souvenir of his visit he leaves the following copy of a verse, which he remembers reading in a New York newspaper, at the time of his former visit, as a prefix to an advertisement, and very pertinently asks, "Was it a prophecy?":

"The spirit of reform, anon,
Will, at the rate she's rushing on,
Yoke lightning to her railroad car,
Or, like some swift and shooting star,
Or some bright gleam of radiation,
Ride the whole circuit of creation."

OUR LONDON LETTER.

Engineers', Electricians', Etc., Exhibition at the Agricultural Hall.—The number of electrical exhibits is small, but there are some novelties. The hall is lighted by Kent's new arc lamp, which, owing to the simplicity of its mechanism and the consequent low price, is already in very great demand. The lamps are made to run three on a 100 volt circuit, and in the ordinary size, work with any current from 8 to 24 amperes. A lamp shown is over 4,000 candle power. Messrs. Pyke and Barnett show their new spark coils, which are made to work from either a transformer circuit or an ordinary battery, with Barnett's contact breaker, condenser and transformer, and coils are shown producing 30,000 to 100,000 volts. A Crossley's gas engine, 14 horse-power, nominal, runs a Thomson-Houston dynamo, with a brilliant display of 30 arc lamps. The Consolidated Telephone Construction and Maintenance Company, Limited, show a number of telephones, the Fitzgerald combination, the consolidated magneto-disk, the Bell and Blake magneto, the Austrian consolidated telephones for diving apparatus to give submarine communication, as well as annunciators, switches, etc. Messrs. Winnall, Callow & Winnall, show a number of Newall engines, one driving a three unit Phœnix dynamo. The British Gas Engine Company have a four horse-power Atkinson patent Lyle gas engine, driving a 60 volt Statter dynamo, supplying a small installation of incandescent and arc lamps, for which Mr. Atkinson assured me they had a large demand. Large Griffin gas engines have been put down by Messrs. Dick, Kerr & Company, and run a Tyne dynamo of Messrs. Ernest Scott and Company, and a Phœnix dynamo of Messrs. Paterson & Cooper. Dan. Rylands, of 62 King William street, E. C., and Barnsley, show glass lined iron piping for use in electric wiring. Iron pipe is coated inside with cement, and glass tubing is blown on inside. Joints and bends are made equally with straight lengths, and the estimated cost when fixed, is 20 per cent. cheaper than lead piping. The Acme Electric Works have an exhibit of switches, cut-outs and other apparatus. Messrs. Fawcett, Preston & Company, of Liverpool, show their gas engine, which is used for electric lighting in Liverpool. Messrs. O Berend & Company, of 61 Fore street, E. C., show under the name of Saxonian bronze ware, a number of ornamented and elaborate fittings, manufactured by continental firms, for whom they act as English agents.

The Lighting of Our Summer Exhibitions.—The lighting of the French Exhibition at Earl's Court, has again been given to the Gulcher Electric Light Company, of Battersea, who made so great a success at the Spanish Exhibition last year. The Military Exhibition on the Chelsea embankment is to be lighted by Messrs. Davey, Paxman & Company.

Electric Launches for the Edinburgh Exhibition.—The four launches to be run on the canal at Edinburgh, have been designed by Messrs. Morton & Williamson, and built by Messrs. T. B. Seath & Company, of Glasgow. The length is 40 feet, width, 6 feet, 6 inches, and draught, 2 feet, 1 inch, and each will carry 40 passengers. Messrs. Immisch & Company have the responsibility of the electrical equipment, which is similar to that used for the Thames launches. The charging plant will consist of 25 horse-power engine and an Immisch dynamo with suitable switch arrangements for charging four launches at the same time. The motors have a capacity of output of about 3½ brake horse-power at 800 revolutions per minute. The propellers are coupled direct to the motor shafts. To the motor bed is attached a ball bearing thrust bearing, constructed in combination with the plain bearing of the motor, an arrangement invented and patented by Messrs. M. Immisch & Company, which reduces friction to a minimum and prevents noise and vibration. The high speed propellers have been made after a careful course of experiments and give the highest efficiency hitherto attained with such small blades, and have been designed for going both ahead and astern. The steering, starting and reversing gear, have been so arranged that one man has the launch entirely under control.

Proposed Electrical Club.—The fact that the electrical profession should have further facilities for interchanging ideas and of meeting their fellows professionally and in friendship, than is afforded by the meetings and discussions of the Institution of Electrical Engineers, has induced several prominent electrical engineers to take the matter in hand and enable English electricians to offer the same hospitality to our American visitors as is afforded by them in their well-appointed Electric Club. As the number of members would necessarily be limited, it has been decided to affiliate with some good standing club, and as the committee of the Whitehall Club, which is the representave civil and mechanical engineering house, have agreed to dispense with entrance fee in the case of members of the proposed club joining in a body, it has been selected as the most fitting.

A Verb for Electric Propulsion.—In a late letter in the *Times* newspaper, Viscount Bury requested a single verb to express electrical traction, and among a large number suggested have been: To electrize, electricise, electrate, to run, speed, squirm, to coulounb, volise, to spark, gleam, flash, to tric, to motor or mote, to amber and to faradate.

Ferranti Smoking Concert.—The string band of the employes of the London Electric Supply Corporation, Limited, and Mr. S. Z. de Ferranti gave an excellent smoking concert a couple of week since, at which over 600 of the engineering staff were present, as well as several of the engineers of the more prominent electric lighting companies. Mr. Ferranti's partner, Mr. Sparks, was presented with a tea and coffee service and an address, on the occasion of his approaching marriage.

London Electric Supply Corporation, Limited.—The third ordinary general meeting was held at Cannon Meet Hotel on the 31st ulto., with Mr. J. S. Forbes in the chair. The result, after two years' work and an expenditure in plant and machinery alone of £68,000, is not very encouraging—two 30,000 light dynamos working at a quarter of their proper voltage. The total expenditure for the two years amounts to £505,258, the building absorbing £102,738 and the plant and machinery £68,342. The Provisional Order cost nearly £4,500, mains during 1888–89 are down for £44,307, converters £26,632, and meters for £1,632. The sale of current brought in £25,871, and with this and other sources of revenue the corporation are enabled to pay a dividend on the preference shares and to carry a small sum forward. Mr. Ferranti in his report speaks most confidently, and we are sure the whole electrical world trusts he may be justified and make his grand enterprise a brilliant success.

The Wenham Company, Limited.—This company have added to their business in gas lighting an electrical department, and now undertake all kinds of lighting and engineering work. At the present time they are engaged in lighting up the private theatre and winter garden of Madame Adelina Patti, at Craig-y-nos Castle, Wales.

Electric Lighting in Galway.—The Galway Harbor Commissioners have accepted the tender of the Galway Electric Company to light the old and new docks for a sum of £40 per annum. The lights at the harbor will be chiefly incandescent lamps, and the water-power of the Corrib river is to be utilized for the production of the electric light. It is said that there is sufficient water-power in the town of Galway to turn all the mills in Ireland.

Siemens Works, Berlin.—Messrs. Siemens & Halske's works were visited last week by the foreign members of the Labor Protective Conference. The chief engineer, Herr Frischen, acted as guide.

Moet and Chandon.—The premises of Messrs. Chandon and Cie. at Epernay, the proprietors of the celebrated champagne, have been fitted with a most complete electrical installation, both for lighting and traction Babcock & Wilcox boilers supply steam to three Breguet engines, double cylindered, at 350 revolutions per minute, each driving a couple of dynamos. Three of the dynamos supply current for the light, 250 amperes each, 100 to 115 volts. The machines are Breguet, Pacinotti Gramme type. The other three dynamos are Manchester type, two for transmission of power, 55 amperes, 250 volts, and one for arc lighting, 200 amperes, 70 volts. The motors used are the Roffard, and are made by Breguet. The pumps, hauling apparatus, etc., are all driven by electricity, and the whole premises, including cellars and dwelling houses, are lighted up. The installation has been most successful, and other champagne growers are following suit.

"L'Elettricata," of Milan.—The editor would be glad to receive answers to the two following questions, from all competent authorities, the replies to be published in an early issue. 1. What has been the most important electrical invention, discovery or investigation, of the past year? 2. What application of electricity, already known, will show the greatest progress during this present year?

Personal.—General O. E. Madden, the president of the New York Electric Club, who has been stopping at the Hotel Metropole, has been visiting Paris since Easter. The General made many friends in this city during his brief visit.

CHARLES FFRENCH.

London, April 22.

—— Susquehanna, N. Y., is soon to be a well lighted town. The residents of the place will have at their command the light supplied by the Westinghouse alternating current system and the streets will be rendered safe and pleasing by illumination derived from the arc lighting apparatus of the Westinghouse Company. The company which is to do the lighting starts out with a capacity of 750 incandescent and 80 arc lights.

The Wenstrom Consolidated Dynamo and Motor Company.

One of the recent strong candidates for favor in electric light and power circles is the Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, of which that enterprising house, Chadbourne, Hazelton & Company, Philadelphia, are the sole agents. The Wenstrom Company was recently organized in the city of Baltimore with E. L. Tunis, the well-known lumber man, as president, and a number of leading capitalists as directors. Among these are: Messrs. Enoch Pratt, D. D. Mallory, Robt. Rennert, Geo. F. C. Latrobe, Governor E. E. Jackson and Ex-Governor James B. Groome.

The company has been formed with a capital stock of $1,000,000 to manufacture dynamos and motors for lighting and street car purposes, having purchased the patent rights of Jonas Wenstrom, of Sweden, for the United States.

Mr. H. F. Parshall, formerly with the Sprague Motor Company, is at the head of the electrical work of the company.

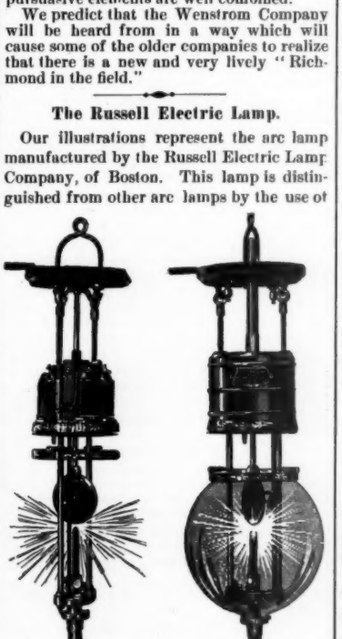
The Wenstrom dynamo, although a newcomer, is familiar to the majority of our readers, and is a remarkably efficient and compact machine. The company will build an immense factory in the suburb of Baltimore, on the line of the Pennsylvania Railroad, in addition to its present factory in that city. About 1,000 acres of land have been purchased, we understand, and a factory, which will rank along with the greatest electrical factories of the day, will soon make its appearance in Baltimore.

We think the Wenstrom people are to be congratulated on arranging with the active and progressive Philadelphia company mentioned above as its sole agents. This company is composed of Messrs. A. H. Chadbourne, Wm. Hazelton, 3d, and W. A. Stadelman, all three progressive and capable young men, in whom practical, financial and pursuasive elements are well combined.

We predict that the Wenstrom Company will be heard from in a way which will cause some of the older companies to realize that there is a new and very lively "Richmond in the field."

The Russell Electric Lamp.

Our illustrations represent the arc lamp manufactured by the Russell Electric Lamp Company, of Boston. This lamp is distinguished from other arc lamps by the use of



a carbon disk in place of a pencil for the upper carbon. The disk is about four and a half inches in diameter, and the lower pencil about 14 inches long. The lamps will burn from 18 to 24 hours, according to the size. The majority of the light is reflected below the disk. The 12-hour Russell lamp is 30 inches long. An inspection of the lamp at 85 Water street, Boston, will be of interest to intending purchasers of arc lamps.

—— Prof. Elihu Thomson, the genius of the Thomson-Houston works at Lynn, has just moved into his magnificent new mansion on Burrill street, Swampscott, the grounds of which comprise quite a section of what was once the estate of the late E. R. Mudge, of Boston. The professor is one of the most unpretentious of men, and is as pleased with his new home as a boy. When he gets it fitted up, one of the wonders of his estate will be his laboratory, or "shop," as he calls it, which is on the second floor of his stable, and connected with his house by a very artistic bridge. Both house and stable are of brick, and in the old colonial style.

ELECTRIC LIGHT NEWS

—— The Newark Light and Power Company has changed its name to the East Jersey Light, Heat and Power Company, of Newark, N. J.

—— The Consolidated Electric Light and Power Company, of Kansas City, Mo., has increased its capital stock from $100,000 to $200,000. The plant will be largely increased.

—— The Citizens' Gas Light Company, of Newark, N. J., now intends removing all meters from stores and business places where electric light lamps have put the use of gas to practical exclusion.

—— The Fresno *Republican* suggests that electric lights be placed on top of the street gas lamps, so that citizens may be able to see the gas. It observes that the gas lamps have not been cleaned in 27 years.

—— The business of the Berg Electric Light Company has been transferred to the San Antonio, Tex., Gas and Electric Light Company, and the latter company are now in charge of the plant. The terms of sale are private, but rumor has it that the price paid was $30,000.

—— The public building committee of the common council of the city of Boston, consisting of David F. Barry, chairman, and Councilmen Edward E. Drew, Walter L. Hayes, Perlie A. Dyar, George E. Lovett and Assistant Messenger Harry H. Osborn, have been making an inspection of the electric light plants of New York and Philadelphia.

—— The Westinghouse alternating current arc light apparatus has been contracted for during the month of April by electric light companies at the following central station plants: Troy, N. Y., 60; Saratoga, N. Y., 60; Salt Lake City, Utah, 25; Evanston, Ill., 120; Joliet, Ill., 60; Martins Ferry, O., 40; Uxbridge, Mass., 60; Oxford, O., 60.

—— During the month of April, the Westinghouse Electric Company sold its alternate current incandescent apparatus for central station electric lighting plants in the following places: Portsmouth, Va., 1,500 lights; Saratoga, N. Y., increase, 1,500; Salt Lake City, Utah, 500; Mt. Morris, N. Y., 500; Brookline, Mass., 900, increase; Johnstown, N. Y., 500, increase; Springfield, Mass., 3,000, increase; St. Thomas, Ont., 750; Ouray, Col., 750; Sherman, Tex., 750; Detroit, Mich., 6,000; Susquehanna, Pa., 750; Elmira, N. Y., 750, increase.

Mr. Pierce not Guilty.

Chas. W. Pierce, superintendent of the Brush Electric Light Company, of this city, was put on trial in the General Sessions, on April 29th, under an indictment charging him with manslaughter, in killing Henry Harris with an electric current on November 30th last. It was the first indictment of the kind ever found in this country.

Harris was a clerk for Bernard Callan, a dealer in dry goods at Eighth avenue and Forty-third street. About 11 P. M. on November 30th, Harris and Lawrence Hughes, a fellow clerk, were carrying a show case from the sidewalk into the store. The metal corner of the case came in contact with one of three electric lights hanging low in front of the store, and Harris was killed.

After considerable testimony had been heard, including that of Expert Wheeler, Judge Cowing discovered that the whole case hinged on the height of the lamp from the sidewalk. Attorney for the prosecution claimed that, according to the requirements of the Board of Electrical Control, the lamp should have been nine feet from the sidewalk, and according to a policeman's measurements it was short of nine feet. Attorney for the defense did not agree with this. The policeman made the measurements by standing under the lamp, placing his nightstick lengthwise on top of his helmet and then guessing at the remaining distance, about two inches.

After more hypothetical questioning, Judge Cowing said he could not see even proof enough to give the case to the jury. The attorney for the defense asked for an acquittal, and the case was then given to the jury. After a deliberation of 20 minutes, the jury brought in a verdict of "Not guilty."

KINDRED INTERESTS

The Fort Wayne Electric Company, Fort Wayne, Ind., have issued, through their New York office, 115 Broadway, a list of purchasers of their induction system of incandescent electric lighting, invented by M. M. M. Slattery. The list comprises about 75 names of firms and individuals located all over the country, and the total number of lights aggregates nearly 112,000. The largest plant is that of the Manhattan Electric Light Company, of this city, who supply current to 21,000 lamps by this system.

The New "Success" Wood Box Bell.—There are so many of the customers of the Electric Gas Lighting Company, of Boston, who use the "Samson" battery, that this company has found it desirable to produce a low priced bell of first-class quality that will possess all the advantages of higher priced bells, and yet have additional new improvements. The new "Success" bell was designed to meet requirements of any using short line circuits; this bell being of low resistance (like the "Samson" battery), is found to be best adapted for general work. This bell is manufactured with 2½, 3 and 3½-inch gongs, box and back being of various kinds of wood. This company has also nearly ready for the trade a small "Standard" bell, designed to provide for common use the smaller sizes of the company's popular "Standard" iron frame bell. It contains an improved method of adjustment, being quite a novelty as well as a valuable adjunct to the bell; in fact, a simple yet marked improvement over the old style of frame bells that doubtless will be readily recognized and appreciated by the trade.

The Wainwright Manufacturing Company of Massachusetts, report the following recent sales of their improved heaters and condensers, all sold under a ten years' guarantee: Carolina Oil and Creosote Company, Wilmington, Del., seven 200 horse-power condensers; H. M. Sciple & Co., Philadelphia, Pa., one 8 horse-power; H. S. Walker, Chicago, Ill., one 15 horse-power; Buckeye Engine Company, Salem, O., one 50 horse-power; Kress Brewing Company, New York, N. Y., one 500 horse-power; Randolph & Clowes, Waterbury, Conn., one 200 horse-power; I. E. Palmer, Middleton, Conn., one 80 horse-power; Bailey & Sons, Winthrop, Me., one 50 horse-power; H. M. Sciple & Co., Philadelphia, Pa., one 80 horse-power; H. S. Walker, Chicago, Ill., one 30 horse-power; Ireland & Mathews, Chicago, Ill., one 75 horse-power; Knowles Loom Company, Worcester, Mass., one 150 horse-power; H. S. Walker, Chicago, Ill., one 60 horse-power; Seymour Manufacturing Company, Seymour, Conn., one 300 horse-power; H. S. Walker, Chicago, Ill., one 100 horse-power; St. Louis Machine Company, St. Louis, Mo., one 50 horse-power; H. S. Walker, Chicago, Ill., one 25 horse-power; N. E. Shoe and Leather Exchange, Boston, Mass., one 150 horse-power; J. S. & G. F. Simson, Brooklyn, N. Y., one 25 horse-power; H. S. Walker, Chicago, Ill., one 25 horse power; C. W. Carley, superintendent, Georgetown, D. C., one 150 horse-power; Davis Shoe Company, Lyman, Mass., one 40 horse-power; Bell Armstead Manufacturing Company, Vincennes, Ind., one 75 horse-power; H. S. Walker, Chicago, Ill., one 30 horse-power; New Brighton Glass Company, New Brighton, Pa., one 60 horse-power; Osborne & Kelly Manufacturing Company, Hamilton, Ont., one 100 horse-power; H. S. Walker, Chicago, Ill., one 50 horse-power; Uxbridge and North Uxbridge Electric Company, Uxbridge, Mass., one 150 horse-power; Jno. Post, to L. C. Bass Manufacturing Company, Guilford, Me., one 150 horse-power; A. Coburn & Sons, Hopkinton, Mass., one 50 horse-power; Copeland & Bacon, New York, N. Y., one 100 horse.

RULES FOR ELECTRICAL WORK.

(*Continued from page 7.*)

earth. The interior parts of the device should be insulated from the box. Such boxes should be as far removed as possible from all other electrical devices, pipes, metal, etc., not in contact with the earth. Such boxes should be provided with an arrangement to automatically cut out the current upon an increase of 100 per cent. above the normal current, or should any defect arise or accident occur, whether in the box or consumers' circuit. Preferably an ampere meter should be included in the circuit and connected with an audible alarm, so that warning will be immediately given of any increase of current or accident in box or in the consumers' circuit.

ARC LAMPS.

RULE 59.—No naked lights allowed. Arc lamps, whenever employed, should have their frames and other exposed parts properly insulated from the circuit. They should have their globes closed at the bottom, surrounded by a wire netting to prevent the falling of broken glass, and be provided with means to prevent the carbons falling out; and wherever placed in proximity to combustible material like draperies, goods in show windows, flyings in fabric factories or in wood working establishments, they must be so arranged at the top that no sparks or flame can escape. Arc lamps should never be employed in factories where there is fine dust, as from flour, pulverized cork or similar substances, floating in the atmosphere. Each lamp must be provided with an insulated double pole hand switch, or preferably the lamp should be suspended from a switchboard provided with a double pole hand switch, so arranged as to cut the lamp absolutely out of the circuit whenever desired. Lamps should also be provided with an automatic switch or shunt around each lamp so as to prevent all possibility of the formation of a dangerous arc. Lamps must be located at least 10 feet above the sidewalk.

INCANDESCENT LAMPS.

RULE 60.—Incandescent lamps should in all cases be mounted in insulated sockets which effectually conceal the terminal connections, and when provided with a switch, the handle should be insulated.

DYNAMOS, MOTORS, ETC.

RULE 61.—No dynamo, motor or any apparatus for generating or transforming electricity shall be placed in any room of any cotton, woolen, flax, jute, flour or other mill or factory of a like description, or in any working room or place where any hazardous process is carried on or in which any hazardous goods are stored, except in the engine room thereof; and where it is necessary to locate a dynamo or other source of electricity, transformer or motor in a dangerous position, such apparatus should in all cases be housed and special permission in all such cases first be obtained.

RULE 62.—Dynamos, or other apparatus for generating electricity, and motors should be placed on dry foundations and preferably raised from the floor by means of insulating skids. They should be kept free from an accumulation of oil and dust and be provided with an automatic governing device. A main switch should be placed at or near the dynamo, other generating apparatus, or motor.

STORAGE BATTERIES.

RULE 63.—Storage cells should, in all cases, be arranged with a space of three-quarters of an inch between the cells on insulating supports, and should be located in a dry place, a metal tank, or tank lined with metal, placed under them to catch any leakage. They should be kept free from moisture and dust, and preferably enclosed in a box provided with holes for the escape of gas.

TRANSFORMERS.

RULE 64.—Where secondary transformers are employed, they should be so constructed that a leak between the primary and secondary coils is rendered impossible. The transformers must be enclosed in iron boxes, efficiently connected to earth, and the primary and secondary conductors carried therefrom, clearly marked by painting them in different colors. The iron case enclosing the transformer should have water proof joints, and the name of the conductors plainly marked thereon, by casting the name in the metal at or about the points where the conductors leave the box.

RULE 65.—Where transformers are employed, it is preferable that neither the transformers nor any portion of the primary circuit in connection with them, be placed inside any building, but in a specially prepared fire proof structure apart, which should be perfectly dry. When, however, this cannot conveniently be done, the following precautions should be observed: The transformer should be fastened to the outside of the building, in such a position where it is not easy of access or liable to be interfered with. The conductors from the primary circuit to the transformer should be enclosed in an insulating and fire-proof covering, and so arranged that accidental contact therewith cannot take place. Where necessity requires that the transformers be located within the building, they should be mounted upon a plate of fire proof insulating material, and so located as to be removed from the possibility of interference, and a warning or danger sign should be fixed directly upon them. A cut-out should be included in the primary and secondary circuits, and adapted to act at an increase of 100 per cent. above the normal current, and in the location and arrangement of the transformer special care should be taken to guard against moisture and the destruction of the transformer by an accidental fire occurring from any cause.

TESTS REQUIRED.

RULE 66.—Whenever electricity is supplied from a central station, as well as in all isolated installations generating over five horse-power of electrical energy, all circuits should be tested at full pressure at least twice a day with some approved apparatus designed for the purpose, in order to discover

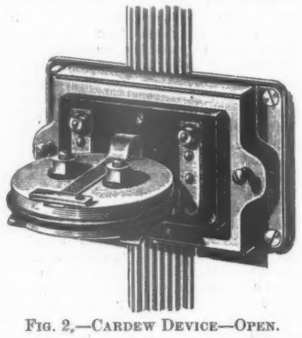


FIG. 2.—CARDEW DEVICE—OPEN.

any current connections or escapes that might exist. A record of these tests should be entered in a book provided for this purpose, and a transcript thereof furnished to the proper authorities once a week.

RULE 67.—Whenever, after proper tests have been made, it is discovered that an earth circuit exists which may become a source of danger, and such circuit cannot be found upon the suppliers' lines, then the suppliers shall have the right to enter the premises of the consumer, after giving one hour's notice, and test the installation within the building and, if necessary, disconnect consumer's circuit from main line, until such time as the consumer shall have repaired the existing leak within the building. Where a consumer's premises are disconnected, the inspector shall immediately file a notice of his reasons for making such disconnection with the proper authorities.

RULE 68.—All work of every description should be of a substantial character and put up in a thoroughly workmanlike manner;

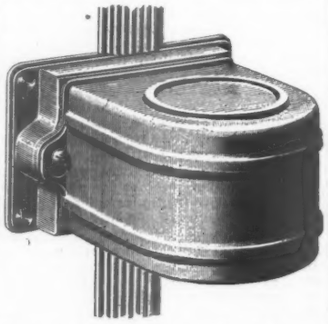


FIG. 1.—CARDEW EARTHING DEVICE—CLOSED.

should be accurately tested at the time of erection for insulation and conductivity.

PLANS AND SPECIFICATIONS REQUIRED.

RULE 69.—When electric light or power circuits are intended to be installed in buildings, full particulars of the proposed installation and all its details must be given in writing to the proper authorities. This must be accompanied by samples of the conductors, with a statement of the maximum current which it is designed to send through each. Specimens of the cut-out switches, plugs, transformers, etc., should likewise be submitted unless they have previously been approved.

The signing of these rules and regulations by an individual or company making the installation shall be a guarantee on his or their part that all the conditions shall be faithfully observed and such reports made as are herein provided.

GENERAL REMARKS.

It is hardly necessary at this day to state that heat and electricity are different states and conditions of one and the same thing, and that each can be readily converted into the other. This fact being admitted, it should be plain to every intelligent man that conductors conveying electric currents should preferably be placed in plain sight where any change in their condition may be immediately noted.

The world, within the last 15 years, has undergone a complete revolution in its system of plumbing. It was formerly the fashion to conceal all the pipes constituting the plumbing of a residence, with the result that bad joints were out of sight and every facility offered to dishonest workmen to do bad and inefficient work. The great mortality due to such bad work at last convinced all that the only way to plumb a house was to put all of the pipes in plain sight. In fact, put all portions of the system in plain sight.

In electricity we have commenced by carefully concealing all the conductors; as a result, fire upon fire has occurred and millions of dollars worth of property has been destroyed. It has at last dawned upon the intelligence of those engaged in the business that the experience learned in plumbing is applicable to installations of electric conductors, and at the present writing there is shown an evident desire to put the wires where they can be plainly seen, or, at least, can be easily inspected and any damage immediately noted and repaired.

The writer feels convinced that electricity is the safest known agent for lighting and power, and that all that is required in the handling of electricity is common sense. Common sense wiring will never produce a fire, common sense distribution of current and the placing of conductors conveying the current will never cause a loss of life or destruction of property by fire.

Perfect safety in electric lighting implies a total separation of the street mains from the consumer's circuit. Economical considerations compel high tension in the street mains and low tension in the consumer's circuit. Where the system employed does not make the differentiation stated, safety requires that there shall be absolutely automatic apparatus located between the street mains and the house mains so that no excess of current may be diverted from the street mains into the premises of the consumer. Many of those in the business object to the *expense* of making a circuit safe, or, at least, what they call the expense. The writer is convinced that it is no more expensive to make a good installation than a poor one. Common sense and intelligence will supply many deficiencies. There is no doubt but that the whole business should be subject to efficient regulation and when this is done, we will hear the last loss of life or destruction by fire from electricity.

A New Insulator.

We have received a communication from Dr. Purcell Taylor, of London, in which he states that, after considerable experiment and research, he has discovered a new insulating material. It is claimed to cost only "one-fortieth" as much as gutta-percha, while it offers a far greater di-electric resistance. The new material is said to be very strong and may be made either flexible or rigid. Any desired color or melting point may be given to it.

We hope to be able, at a later date, to give further particulars regarding this new material.

The Aluminum Battery Electric Light and Power Company have moved from 94 Liberty street to larger quarters at 78-80 Cortlandt street, corner of Washington. The change was made necessary by the large increase in orders for this company's batteries.

The Westinghouse Electric Company, through their Philadelphia office, have just closed a contract with the Pennsylvania Railroad Company, for the Juniata Shops, Altoona, Pa., for one 100 horse-power generator, 90 new alternating arc lights and 800 incandescent lights. Another contract has recently been closed with the Presbyterian Hospital, Philadelphia, for an electric lighting plant consisting of two 300-light dynamos and two compound Westinghouse engines. It is proposed to make this the model hospital plant of the country.

English, Morse & Company, engineers, of Kansas City, Mo., report recent sales of power plants as follows: Pittsburg Gas Company, Pittsburg, Kan., one 125 horse-power "Ideal" engine; Boonville Electric Light Company, of Boonville, Mo., one 80 horse-power "Ideal" engine, with steel boiler and complete plant; Abernethy Furniture Company, Kansas City, Mo., one 30 horse-power "Ideal" engine, with boiler, dynamo, motor and complete plant; Girard Electric Light Company, Girard, Kan., one 60 horse-power steel boiler. Also numerous orders for Lahman-Kirkwood rocking grates, leather link belting, Hill clutch pulleys, Worthington steam pumps, etc.

Cardew Earthing Device.

Messrs. Drake & Gorham have considerably modified and improved the Cardew automatic earthing device, and we give herewith an illustration of the latest perfected pattern, which has been finally adopted by the London Electric Supply Corporation, after an exhaustive series of tests, and will shortly be in use over all their London circuits. The necessity for apparatus of this class was foreseen by Major Cardew some time back, and his patents, which are held by Messrs. Drake & Gorham, cover devices which depend for their action on static attraction or made on the Geissler tube or similar principles.

The static arrangements have been found to give the best results, and have been adopted in the standard instrument as being less liable to derangement.

The action of the device is to connect the secondary circuit to earth automatically whenever a dangerous difference of potential is established between the lamp circuit and earth. This result is obtained by interposing some medium which will be of infinite resistance until a high voltage exists, when a free passage for the current is provided.

The static device illustrated consists of two brass plates placed near, but insulated from, each other. Between these lies a thin foil of aluminium which is retained in position by ebonite pegs, one plate being connected to earth and the other to the secondary circuit.

A flat projection is formed on the upper plate over one end of the foil, so that as soon as a difference of 400 volts is established, one end of the foil lifts by static attraction, and a metallic contact is made between the two plates. The main primary fuses are immediately severed by the increase of current and the supply is cut off.

The two plates are insulated by ebonite rings, and are securely bolted together, so that after being tested at the central station, no skilled labor is required to fix them. It has been shown that the plates can be shaken or rolled about without affecting the voltage at which the foil will lift.

The plates are carried by brass springs to which the connections are permanently made at the back of a solid block of ebonite, so that the act of sliding in the plates makes the connections, and a slot on one side renders it impossible to put them in with the wrong side uppermost.

The plates are all made interchangeable, so that when the foil has acted it is merely necessary to slide in some fresh plates.

It has been suggested that the connecting of the secondary circuit permanently to earth will remove the necessity for this device; but there is no comparison, from a fire risk point of view, for a strain is permanently put on the insulation of the conductors, and a slight leak, which with the automatic device would remain harmless for years, is liable to be developed at any time into a state of danger. This is especially the case in damp situations where the size of the conductor may be reduced by corrosion.

It is evident that the apparatus can be modified to act as a relay and cut off both poles of the circuit, or to ring a bell and drop a danger disk, as has been arranged for one company using continuous currents.—*London Electrical Review.*

Lighting the Statue of Liberty.

The following is an abstract of bids received by Major D. P. Heap, U. S. A., engineer Third Light-House District, for furnishing and delivering a dynamo for the Statue of Liberty, in New York Harbor:

Name and Address.	For 2 Dynamos Complete.	For 1 Dynamo Complete.	For Duplicate Armature Complete.
United States Electric Lighting Co., New York.	$2,400	$1,200	$170
National Electric Lighting Co., Eau Claire, Wis.	2,500	1,300	375
Thomson-Houston Electric Co., New York	3,548	1,774	265
Troy Electric Dynamo Co., Troy, N. Y.	1,983	993	375
United Edison Mfg. Co., New York	3,691	1,983	500

Remarkable Telegraphy.

A correspondent of the Newark *Advertiser* sends from Paris an extravagant account of rapid telegraphy over a long distance: "Some months ago there was arranged a direct telegraphic communication between London and Rome, working on the Hughes system, with relays at Paris, Lyons, Turin and Florence. Its operation since then has been very regular, although accidental disarrangements have been somewhat more frequent upon this line, 2,200 kilometers long, than upon shorter lines. Recently, experiments have been tried on this line with Wheatstone apparatus, with relays at Paris, Lyons and Turin. It has been possible to secure 120 words a minute between London and Rome, and this speed evidently could be surpassed if the fourth relay was used at Florence so as to divide the Turin-Rome section, which is about 840 kilometers long, into two parts. There is no doubt that a speed of transmission of 200 words a minute would be reached, since this speed has been attained upon the London-Paris section." Whew!

R. D. WILSON & CO.,

ELECTRIC SECURITIES

EXCLUSIVELY.

—— We offer for sale ——

Local Electric Co.s' Bonds, netting 6%
Mfg. Co.s' Preferred Stocks, " 7%
" " Common Stocks, " 8%

STOCK OF ALL THE ELECTRIC LIGHT AND WELDING MANUFACTURING COMPANIES.

Full information given on all Electric Securities.

Correspondence Invited.

118 DEVONSHIRE ST., Room 21, BOSTON.

WANTED.—A young man, graduate of Cooper Union, and experienced mechanic, desires a position as assistant to an Electrical Engineer; can also assist at draughting.

S. EDWARDS,
146 Rutledge St., BROOKLYN, N. Y.

Notice for Proposals for Lighting the Streets in Holyoke, Mass., by Electricity.

The Committee on Fuel and Street Lights, of the City of Holyoke, Mass., invite proposals for lighting the streets of said city by electricity.

The proposals shall state the price per lamp for which the bidder will furnish for and during the period of five years, electric lamps to the number of 125 of what is known as full arc lamps, or 160 of half arc lamps and all poles, including lamp poles properly equipped for the lamps, and all apparatus, fixtures and accessories required for said lamps, and furnishing electric light, and operate and maintain and keep in repair said lamps, apparatus, fixtures and accessories, according to the terms and provisions of the specifications prepared therefor, now in the office of the City Clerk of said Holyoke, where they may be inspected and examined.

The proposals must be sealed and addressed to the Chairman of the Committee on Fuel and Street Lights, Holyoke, Mass., and must be in the said chairman's hands on or before May 9th, at 6 o'clock, P. M.

The committee reserve the right to reject any or all bids.

M. P. CONWAY, Chairman.

Holyoke, Mass., April 26, 1890.

PROPOSALS FOR SUPPLIES.

Office of Light House Engineer,
Third District,
Tompkinsville, N. Y., April 21, 1890.

SEALED PROPOSALS will be received at this office until 12 o'clock M. on Saturday, the 10th day of May, 1890, for furnishing Miscellaneous Articles for the Light House Establishment.

The articles needed consist of 21 numbered lots, embracing, respectively, Charcoal, Coke and Cumberland Coal; Building Material; Engineers' Supplies; Hardware, Tools, etc.; Iron and Steel; Belting; Graphite Paints, etc.; Lumber; Boiler Covering; Plate Glass; Galvanized and Russia Sheet Iron, Tin, Solder, Sheet Zinc and Iron Wire; Sheet Brass, Composition, Brass and Nickel Castings; Bells; Acids; Iron Castings; Sheet Iron Smoke Stacks for Boilers; Electrical Supplies; Electoplating Supplies; Shooks for Oil Supply Boxes; and Miscellaneous Articles; all of which are enumerated in the specifications attached to the form of bid, which may be obtained on application to this office.

Samples may be seen or information obtained at this office concerning any article not sufficiently described in the specifications.

Bids will be received for one or more numbered lots complete.

The right is reserved to reject any or all bids, to strike out any item or items in the specifications, and to waive any defects.

D. P. HEAP,
Major of Engineers, U. S. A.,
Engineer Third Light House District.

NON-ELECTRIC TELEPHONES

THE MOST

Efficient, Desirable and Practicable.

SEND FOR APRIL PRICE LIST.

NATIONAL TEL. MFG. CO., BOSTON.

(Mention this Paper.)

SUNNY OFFICES
IN THE
"NEW ENGLAND"
AND
"HATHAWAY" BUILDINGS

Foot of Summer St., next to N.E. R.R. Depot.

As a rule, business men spend most of their DAYS in offices which should be SUNNY and PLEASANT to be HEALTHY.

Our rooms face South and are

COOL in SUMMER & WARM in WINTER.

ARTHUR H. TABER, Agt.,

Room 28. 620 ATLANTIC AVE.

The New Metal of the Present, no longer "The Metal of the Future."

ALUMINIUM!

JUST READY.

ALUMINIUM—Its History, Occurrence, Properties, Metallurgy and Applications, including its Alloys. By Joseph W. Richards, M. A., A. C., Instructor in Metallurgy at the Lehigh University. Second edition, revised and greatly enlarged. Illustrated by 28 engravings and two diagrams. 310 pages. 8vo.

Price, $5.00, by mail, free of postage, to any address in the world.

CONTENTS: Chapter I.—History of Aluminium. II.—Occurrence of Aluminium in Nature. III.—Physical Properties of Aluminium. IV.—Chemical Properties of Aluminium. V.—Properties and Preparation of Aluminium Compounds. VI.—Preparation of Aluminium Compounds for Reduction. VII.—The Manufacture of Sodium. VIII.—The Reduction of Aluminium Compounds from the Standpoint of Thermal-Chemistry. IX.—Reduction of Aluminium Compounds by means of Potassium or Sodium. X.—Reduction of Aluminium Compounds by means of Potassium or Sodium (Continued). XI.—Reduction of Aluminium Compounds by the use of Electricity. XII.—Reduction of Aluminium Compounds by other means than Sodium or Electricity. XIII.—Working in Aluminium. XIV.—Alloys of Aluminium. XV.—Aluminium-Copper Alloys. XVI.—Aluminium-Iron Alloys. XVII.—Analysis of Aluminium and Aluminium Alloys. Index.

☞ *A circular of four pages, 4to, showing the full Table of Contents of this thoroughly revised and recast treatise, showing the state of the industry up to 1890, and which has played an important part in the rapid development of this New Metal, will be sent free, and free of postage, to any one in any part of the world who will furnish his address.*

☞ *Our new and revised Catalogue of Practical and Scientific Books, 88 pages, 8vo, and our other Catalogues, the whole covering every branch of science applied to the arts, sent free, and free of postage, to any one in any part of the world who will furnish us with his address.*

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers and Importers,
810 Walnut St, Philadelphia., Pa., U. S. A.

ELECTRIC CONDENSERS WM. MARSHALL, MANUFACTURER. Standards a Specialty
Rooms 2 and 4, University Building, New York.

Large Factory Facilities.

THE OWNERS of a large, modern manufacturing establishment in central New York, have business which occupies the plant for a part of the year only. They would be glad to undertake the manufacture of

Electrical Apparatus, Dynamos, MOTORS

Or any Appliances used in Electric Lighting or for Traction Purposes,

for parties who may not have sufficient facilities for present orders. Capacity of the foundry, thirty tons of casting per day, which can be increased if desired. Machine shop well equipped with modern machinery and capacity for employing 150 to 200 men.

This factory is exceptionally well located for receiving supplies and for getting low rates of freight both east and west.

Correspondence addressed to "ELECTRIC," care of Editor ELECTRICAL REVIEW, will receive prompt attention.

ELECTRICAL PATENTS

Index of Inventions for which Letters Patents of the United States were issued on April 29, 1890.

426,437 Electric heater; Chas. W. Drew and Edw. R. Francis, Minneapolis, Minn.

426,452 Crossing for overhead wires; John Kuehule, Detroit, Mich.

426,462 Tablet for telephones and clamp attachment for the same; Jno. B. Moins, Cincinnati, Ohio.

426,471 Brush and holder for electrical machines; Edwin W. Rice, Jr., Lynn, Mass.

426,479 Apparatus for manufacturing electric light carbons; Henry A. Tremaine, Cleveland, Ohio, assignor to the Standard Carbon Company, same place.

426,499 Device for measuring electrical currents; Thos. H. Hicks, Detroit, Mich., assignor to the Electrical Invention Company, same place.

426,522 Electrical train signal; Geo. D. Burton, New Ipswich, N. H.

426,527 Automatic determining device for phonographs; Thos. A. Edison, Llewellyn Park, N. J.

426,534 Apparatus for erecting poles; Russell Hathaway, Fairhaven, Mass.

426,563 Induction coil; Anthony M. Frankenberg, Baltimore, Md.

426,570 Regulator for dynamos and motors; William T. Peel, St. Paul, Minn., assignor of one-half to Jacob R. Stemer, same place.

426,573 Potential-controlling device. 426,574 Regulation of electric motors; Wm. Stanley, Jr., Great Barrington, Mass.

426,576 Dynamo electric machine; Jonas Wenstrom, Orebro, Sweden.

426,580 Electric railway; Edward M. Bentley, New York, N. Y.

426,591 Quadruplex telegraphy. 426,819 Duplex and quadruplex telegraph; Francis W. Jones, New York, N. Y.

426,621 Electrical signaling apparatus; James U. Mackenzie, New York, N. Y., assignor to the Gamewell Fire Alarm Company, same place.

426,650 Electric engine; Robert W. Thompson, Cleveland, Ohio, assignor of one-eighth to Geo. W. Tibbitts and James C. O'Neil, both of same place.

426,657 426,658 Electric motor car. 426,708 Electric railway car; John A. Brill, Philadelphia, Pa.

426,660 Electric lamp post; William Carroll, Chicago, Ill.

426,688 Electric fire alarm; Chas. H. Shaffer, Rockford, Ill., assignor of one-half to Jones, Woodruff & Co., same place.

426,691 Fire alarm telegraph system; John Speicher, Jersey City, and Frederick T. Fearry, Newark, N. J., assignors to the Newark District Telegraph Company, of New Jersey.

426,693 Annunciator; Chas. W. Stimson, New York, N. Y.

426,699 Regulator for dynamos; James J. Wood, Brooklyn, N. Y.

426,705 Circuit-closing hinge for electric burglar alarms; William M. Bleakley, Verplanck, N. Y.

426,724 Method of making electrodes for secondary batteries; Geo. E. Heyl, Charlottenburg, Prussia, Germany.

426,749 Automatic telegraph; Frank Anderson, Peekskill, N. Y.

426,778 Safety hook for electric lights; John Dalton, Danvers, Mass., assignor to Theo. G. Lee, same place.

426,781 Electric refrigerating apparatus for railway cars; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.

426,917 Thermostatic circuit closer; Wm. H. Chambers, Fulton, Ky., assignor of one-fifth to Jesse T. Holman, Harris Station, Tenn.

426,932 Galvanic battery; Fernand Gendron, Bordeaux, Gironde, France.

426,941 Telegraph key; Oscar Kleber, Allegheny, Pa.

426,971 Electrical fuse; Hugo Tinnmann, Cleveland, Ohio, assignor to the United States Mine Supplies Company.

426,989 Apparatus for electrical communication; James L. Cutler, Piketon, Ohio.

426,992 Electrical measuring instrument; Madison M. Gawer, Newark, N. J.

427,014 Electrical tell-tale device; Edw. F. Roberts, Rochester, N. Y.

427,022 Electrical measuring instrument; Edw. Weston, Newark, N. J.

Issued April 22.

426,222 Electric railway signal; Geo. A. Tower, Richmond, Va.

426,247 Electro-magnetic instrument; Patrick B. Delany, South Orange, N. J.

426,266 Coin-controlled apparatus for telephones; William Gray, Hartford, Conn., assignor of one-half to Chas. Soby, same place.

426,269 Electric railway system; Ludwig Gutmann, Fort Wayne, Ind.

426,304 Thermostat; John P. McMahon, Buffalo, N. Y., assignor to the McMahon Thermograph Company, Jersey City, N. J.

426,307 Electric annunciator call; William S. Paca, Baltimore, Md., assignor to the Eastern Electric Company, same place.

426,317 Coupling for electric cars; Louis Pfingst, Boston, Mass.

426,335 Armature for electric meters; Oliver B. Shallenberger, Rochester, assignor to the Westinghouse Electric Company, Pittsburgh, Pa.

426,338 Lightning arrester; Arthur D. Spear, Greenville, S. C.

426,348 Dynamo electric machine; Merle J. Wightman and Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

426,377 Lubricator; Thos. J. Hart, Buffalo, N. Y., assignor of one-half to Geo. B. Essex, same place.

426,379 Electric railway car; John C. Henry, Kansas City, Mo.

426,380 Electric motor and dynamo; John C. Henry, New York, N. Y.

426,381 Electric gas lighter; Chas. H. Hinds, New York, N. Y.

426,382 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor by mesne assignments to the Thomson-Houston Electric Company, Boston, Mass.

426,395 Apparatus for electric railway signaling; Chas. H. Rudd, Evanston, Ill., assignor of one-half to James W. White, James Clarence White and H. M. Lewis, trustees, all of Philadelphia, Pa.

426,405 Arc light; James J. Wood, Brooklyn, N. Y.

GEORGE CUTTER, Electrical Supplies, 80 Adams Street, CHICAGO.
SIMPLEX WIRES. BERNSTEIN LAMPS. BRYANT SWITCHES.

Fuse Wire! Fuse Wire!
Accurately Determined. Carefully Made by a new Process. For Sale by
W. H. GORDON & CO.,
ELECTRIC LIGHT AND POWER SPECIALTIES,
Send for Catalogue. 115 BROADWAY, NEW YORK.

ELECTRICAL CONTRACT WORK.
Detailed Estimates Made and Contracts Taken for
Equipment of Complete Steam & Electrical Plants
of any system of Arc and Incandescent Lighting, Central Stations and Electric Street Railways operated Overhead, Underground or by Storage Batteries
—ADDRESS—
EUGENE T. LYNCH, Jr., Consulting Engineer, 180 Broadway, New York.

C. M. BLANCHARD
ELECTRICAL CONTRACTOR & ENGINEER
Girard Building, Broad & Chestnut Sts.
PHILADELPHIA.

Daniel W. Baker. Cyrus O. Baker, Jr.
BAKER & CO.,
Importers, Melters and Refiners of
PLATINUM,
408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased

STANDARD ELECTRIC TEST INSTRUMENTS.
AMMETERS AND VOLTMETERS FOR DIRECT AND ALTERNATING CURRENTS.

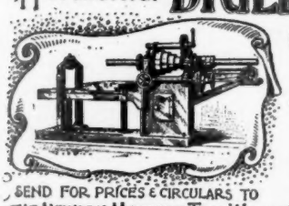
QUEEN'S NEW Portable Combination Testing Set, WITH GALVANOMETER.
We pay special attention to recalibrating Ammeters and Voltmeters.
Send for Catalogue I-66 of Electric Test Instruments.
QUEEN & CO., PHILADELPHIA.

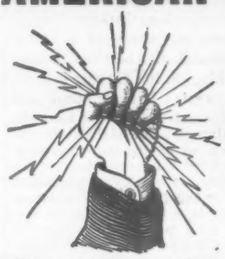
SEND FOR CATALOGUE.
THE WYCKOFF PIPE CO.,
MANUFACTURERS OF
WOODEN PIPES FOR
UNDERGROUND ELECTRICAL WIRES.
We have large works for creosoting Lumber, R. R. Ties, Telegraph Poles, &c., &c.
WILLIAMSPORT, PENN.

NEW YORK ELECTRIC SUPPLY CO.
MANUFACTURERS, IMPORTERS AND DEALERS IN
ELECTRIC SUPPLIES OF EVERY DESCRIPTION,
Electric Light, Telephone and Telegraph Apparatus, Dynamos, Electric Motors, Primary and Storage Batteries, Etc.
No. 94 LIBERTY ST., - NEW YORK

SILKS. Full assortment of different sizes and qualities on BRAIDER SPOOLS, ready for the machines, in Red, Yellow and Green. Other colors to order. Send for Sample and Prices.
WM. MACFARLANE, & CO., 81 Grand Street, New York.
Telephone No. 971 Spring. Mill, Bergen Point, N. J.

THE CLARK
ARC LIGHTING SYSTEM
Is the Safest and Most Economical in the United States.
Manufactured by the CLARK ELECTRIC CO., 192 Broadway, N. Y.

Horizontal DRILLING AND BORING MACHINE

Great Power.
WIDE RANGE OF
REVERSIBLE FEEDS.
SEND FOR PRICES & CIRCULARS TO
THE NEWARK MACHINE TOOL WORKS. Newark, N.J.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Sec. & Electrician.
AMERICAN ELECTRICAL WORKS,

Manufacturers of Patent Finished
ELECTRIC LIGHT WIRE,
MAGNET WIRE, OFFICE & ANNUNCIATOR WIRE.
RUBBER COVERED WIRE, LEAD ENCASED WIRE.
TELEPHONE & INCANDESCENT CORDS.
FARADAY CABLES.
Office and Factory, 67 STEWART STREET., PROVIDENCE, R. I.
New York Office, 18 Cortlandt St., P. C. Ackerman, Agt.

EUGENE F. PHILLIPS, President. JOHN CARROLL, Sec'y-Treas.
EUGENE F. PHILLIPS ELECTRICAL WORKS, LTD.

Manufacturers of
ELECTRIC LIGHT WIRE,
MAGNET WIRE, OFFICE & ANNUNCIATOR WIRE,
RUBBER COVERED WIRE, LEAD ENCASED WIRE,
TELEPHONE & INCANDESCENT CORDS.
FARADAY CABLES.
OFFICE AND FACTORY, St. Gabriel Locks, MONTREAL, CANADA.

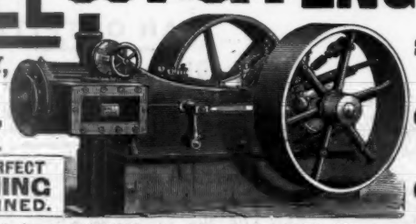
PHŒNIX GLASS CO
OF PITTSBURGH, PA.
MANUFACTURERS OF A FULL LINE OF
ELECTRIC LIGHT
GLOBES SHADES
BOTH ARC AND INCANDESCENT.
RICH CUT, OPAL, CLEAR, ETCHED, ROUGHED, ETC.
ADAPTED TO ALL SYSTEMS.
729 BROADWAY, NEW YORK.
(CORNER WAVERLY PLACE), AND
43 SIXTH AVE., PITTSBURGH, PA.

HIGHEST AWARD, PARIS EXPOSITION, 1889.

THE ONLY Gold Medal AWARDED FOR Electric Batteries.

TRADE GONDA MARK.
The Standard Open Circuit Batteries of the World,
AND THE BEST.
THE LECLANCHÉ BATTERY CO.,
149 West 18th Street, New York.

BALL AUTOMATIC CUT-OFF ENGINE



RELIABILITY, ECONOMY, SIMPLICITY, DURABILITY.

THE MOST PERFECT GOVERNING EVER OBTAINED.

STANDARD

DOUBLE COMPOUND

TANDEM COMPOUND

For Electrical Lighting, Electrical Railways and purposes where perfect governing is required, it has no equal.

BALL ENGINE CO., ERIE, PA.

NEW ILLUSTRATED CATALOGUE NOW READY.

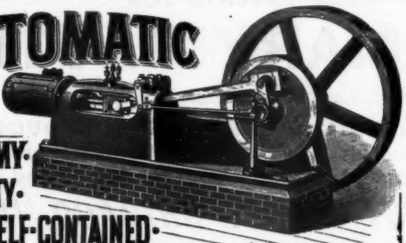
Contains a great variety of New Machines, and all the latest improvements on our regular manufactures.

MILLING MACHINES, SCREW MACHINES, ETC.

THE GARVIN MACHINE CO.,

Laight and Canal Sts., New York.

THE RICE AUTOMATIC



GUARANTEED ECONOMY · REGULATION · DURABILITY · SIMPLICITY · SELF-CONTAINED · 8 TO 300 H.P. · PAIR & TANDEM COMPOUNDS · THE JOHN T. NOYE MFG CO. BUFFALO. N.Y.

FAIRBANKS, MORSE & CO., Western Representatives, Chicago, St. Louis, Kansas City, Omaha, Denver, St. Paul

ALBERT FISHER, 89 Liberty Street, New York. Eastern Agent.

JARVIS ENGINEERING COMPANY,

CONTRACTING ENGINEERS for ERECTING COMPLETE STEAM PLANTS

For Electric Lighting and Power Stations.

—: AGENTS FOR :—

ARMINGTON & SIMS ENGINES,
JARVIS BOILER SETTING,
to burn Anthracite Coal and Coke Screenings,
NATIONAL FEED WATER HEATER,
NATIONAL ROCKING and
SHEFFIELD GRATE BARS.

61 Oliver Street, Boston.

SEND FOR NEW CATALOGUE.

POND ENGINEERING CO.,

ENGINEERS AND CONTRACTORS.

Complete Steam Plants for Electric Light and Power.

Engines, Boilers, Furnaces, Grates, Heaters, Pumps, Injectors, Pipe Work, Belting, etc., designed with special reference to the HIGHEST EFFICIENCY.

Our Extended Experience Enables us to Guarantee Satisfaction. Send for New Illustrated Pamphlet.

ST. LOUIS, CHICAGO, KANSAS CITY AND OMAHA.

CHARLES R. VINCENT & CO.,

15 CORTLANDT STREET, NEW YORK,

Ball High Speed Automatic Cut-off Engines

MANNING VERTICAL TUBULAR BOILERS,

Complete Steam Plants Furnished and Erected.

WILLIAMS & POTTER,

15 CORTLANDT ST., NEW YORK.

Engineers & Contractors,

GENERAL AGENTS,

STRAIGHT LINE ENGINES

PALERMO MICA CO.

MINERS OF

MICA

WAREHOUSE, 27 PECK SLIP,

THE ONLY COMPANY PRODUCING MICA IN THE UNITED STATES.

NEW YORK.

FRICTION CLUTCH PULLEYS

AND CUT-OFF COUPLINGS.

CHARACTERISTICS:

Vice-Like Grip of Clutches Optionally Gradual or Sudden. Large Friction Surfaces Prevent Undue Wear. Disengagement of Clutches is Positive. Pulley Shaft is Automatically Oiled. They have a Good Record. Grip of Clutches Self-Maintaining. Experts are invited to examine Peculiarities.

ECLIPSE WIND ENGINE CO.,

Send for 1889 Catalogue. Beloit, Wis.

JOHN POST, JR., & CO.,

MECHANICAL ENGINEERS.

AGENTS FOR THE

IDE AND ROLLINS ENGINES.

Complete Steam Plants furnished at short notice. MASON BUILDING, BOSTON.

New Tangye Buckeye Automatic Cut-off Engines.

25 to 1,000 H. P.

In Use, Over 2,500.

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and Superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 200 H. P. for driving Dynamo Machines a Specialty. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail.

Address BUCKEYE ENGINE CO., Salem, Ohio.

SALES AGENTS:

W. L. SIMPSON, 10 Telephone Building, 18 Cortlandt Street, N. Y.

M.W. ROBINSON, 154 Washington St., Chicago, Ill. Robinson & Cary Company, St. Paul, Minn

16x24 DOUBLE BRAIDER

NEW ENGLAND BUTT CO.,

Providence, R. I.,

MANUFACTURERS OF

Braiding Machinery

FOR COVERING

TELEGRAPH, TELEPHONE

AND

ELECTRIC-LIGHT WIRE

ALSO

SINGLE AND DOUBLE

WINDERS and BRAIDERS

Of every Description for Silk, Worsted and Cotton Braid.

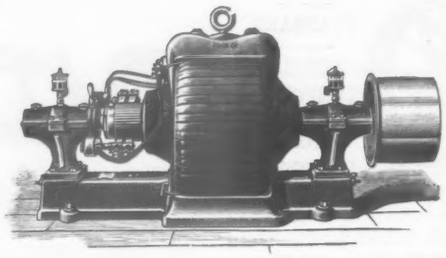
FINE CASTINGS A SPECIALTY

"C. & C." ELECTRIC MOTORS.

The only Motors in which the magnetic circuit forms a perfect circle around the centre of the armature shaft. Thus making the most compact and efficient form of machine that can possibly be devised.

One-eighth horse-power to 50 horse-power in stock.

OVER 8,000 MOTORS IN ACTUAL OPERATION.



FAN OUTFITS.

Electric Blowers for Ship Ventilation.

MOTORS FOR HOISTS AND MINING TRAMWAYS.

Equipment of Machine Shops, Printing Offices, Factories and Entire Buildings, with Electric Power.

New England Office, 63 Oliver Street, Boston.
Philadelphia " 38 South Fourth Street.
Chicago " Phenix Building.

"C. & C." ELECTRIC MOTOR COMPANY,

402 & 404 Greenwich Street, New York.

THE BUTLER HARD RUBBER CO.,

No. 33 MERCER STREET, NEW YORK,

Manufacturers of Hard Rubber Goods of Every Description Including the Celebrated

HARD RUBBER BATTERY CELLS

MANUFACTURED UNDER KIEL'S PATENTS FOR

STORAGE AND PRIMARY BATTERIES.

CHEAPEST AND BEST CELLS IN THE MARKET.

Also SHEET, ROD AND TUBING (Kiel's Patent), for ELECTRICAL PURPOSES at REDUCED PRICES. Standard quality Sheet, Rod, Tubing, Insulator Hooks, Key Knobs, Switch Handles, Telephone Receivers and Battery Syringes constantly on hand. Hard Rubber Specialties of all kinds made to order. Send for Prices and Estimates.

For Sale by CENTRAL ELECTRIC CO., CHICAGO, ILL.

THE NEW
EDISON-LALANDE BATTERY.

MANUFACTURED UNDER AUTHORITY OF

THOMAS A. EDISON.

Primary Batteries for Telegraph "Mains" and "Locals," Electro-Motors, Electro-Plating, Telephone Transmitters, Electro-Medical Instruments, Annunciators and Burglar Alarms, and all Classes of Closed and Open Circuit Work.

FURTHER PARTICULARS AND INFORMATION FURNISHED UPON APPLICATION.

ADDRESS:

EDISON MANUFACTURING COMPANY,

JAMES F. KELLY, General Sales Agent,

19 Dey Street, New York.

THE

UNITED STATES ELECTRIC LIGHTING CO.

(WESTINGHOUSE ELECTRIC CO., Lessees.)

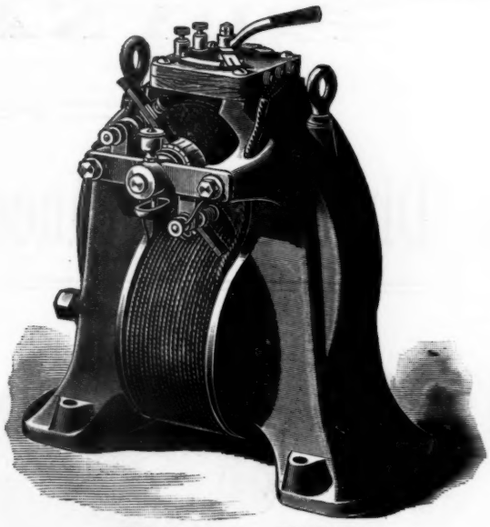
ARC AND INCANDESCENT

ISOLATED ELECTRIC LIGHT PLANTS.

AUTOMATIC DYNAMOS. PERFECT DEVICES.

More than 1,000 Plants in operation in Mills, Hotels, Office Buildings, Theatres, Etc.

ELECTRIC MOTORS and GENERATORS.



NEW U. S. MOTOR.

Direct Current Generators and Motors for all purposes. 1-8 horse-power up to any power desired, and of any required E. M. F. Superior in Design and Workmanship, and Unequalled in Efficiency.

Send for New U. S. Catalogue on Incandescent Lighting and Motors.

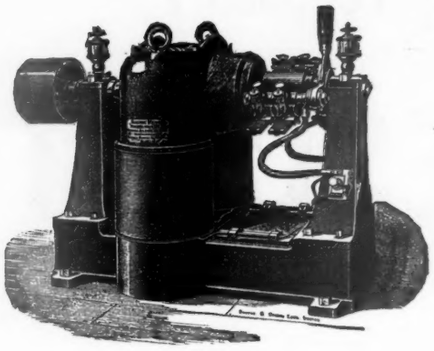
GENERAL OFFICES:

EQUITABLE BUILDING, 120 Broadway, N. Y.

THE

Thomson-Houston Electric Co.

MANUFACTURER OF



MOTORS

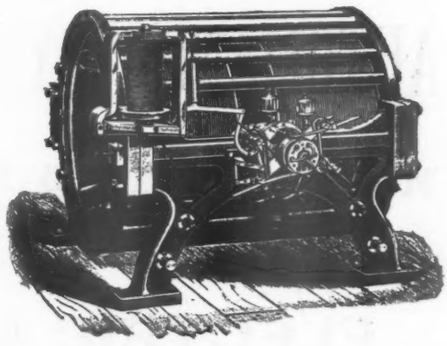
FOR THE

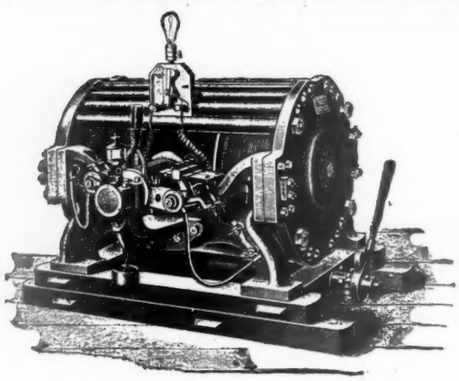
Electrical Transmission of Power.

DYNAMOS

FOR

ELECTRIC ARC LIGHTING.





DYNAMOS

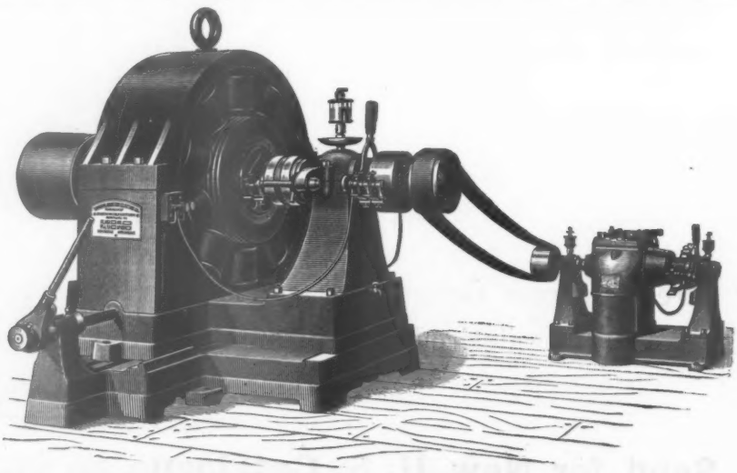
FOR

Direct Current Incandescent Lighting

DYNAMOS

FOR

Alternating Current Incandescent Lighting.



THE THOMSON-HOUSTON ELECTRIC COMPANY.

620 Atlantic Avenue, Boston, Mass.
Wall and Loyd Streets, Atlanta, Ga.
1110 Noble Street, Philadelphia, Pa.
215 West Fourth Street, Cincinnati, O.
503 Delaware Street, Kansas City, Mo.
148 Michigan Avenue, Chicago, Ill.
115 Broadway, New York City.
234 Montgomery Street, San Francisco, Cal.
403 & 405 Sibley Street, St. Paul, Minn.
1333 F Street, Washington, D. C.

INSURE YOUR CENTRAL STATION OR ISOLATED PLANT

IN THE

Electric Mutual Insurance Co.,

OF BOSTON.

Organized and officered by electric light men, to furnish reliable insurance to the electric light and power industries ***AT COST.*** Independent of all Underwriters' Boards. Send for Book of Requirements for Standard Station. No agents employed. Send applications to the Company, in Boston. Insures in any part of the United States or Canada.

WILLIAM BROPHY, Chief Inspector. ***STEPHEN E. BARTON, President.***

Shultz Belting Company,
MANUFACTURERS OF
SHULTZ PATENT FULLED LEATHER BELTING AND LACE LEATHER
Office and Factory: Cor. Bismarck and Barton Sts., St. Louis, Mo.

Our Belting is made of leather tanned on the surface only; the interior (which is the fiber and strength of the hide) is not tanned but rawhide fulled and softened by our patent process. Our Belting is more pliable, hugs the pulley better, transmits more power than any other, and is the only perfect ELECTRIC LIGHT BELT MADE. Agents in all cities. Send for trial belt.

—THE—

KING BELL.

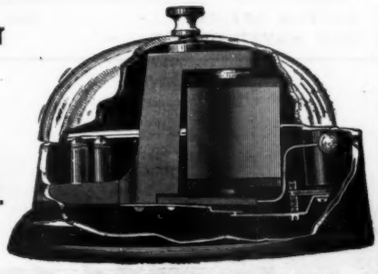
PATENT APPLIED FOR

CUT TWO-THIRDS ACTUAL SIZE.

Something Entirely New.
Easy of Adjustment.
Solid Iron Base.
Nickel-Plated Gong.

Can be Adjusted Before or After Placing in Position.
Working Parts Completely Protected.
Neat, Reliable and Substantial.

FOR PRICES, SEE OUR CATALOGUE.



SECTIONAL VIEW SHOWING WORKING PARTS.

SEND BUSINESS CARD FOR CATALOGUE AND DISCOUNT SHEET.

FRANKLIN S. CARTER. CHAS. M. WILKINS. E. WARD WILKINS.
TRADING AS

PARTRICK & CARTER,
Manufacturers of and Dealers in Every Description of
Electrical Supplies.
Sole Proprietors of the Patent Needle Annunciators,
114 SO. SECOND ST., PHILADELPHIA, PA.
Established 1867.

BOOKS ON ELECTRICAL SUBJECTS
Will be mailed to any address, postage prepaid, on receipt of price. Address,
ELECTRICAL REVIEW PUB. COMPANY,
13 Park Row, New York P. O. Box. 3,329.

EDISON'S
TALKING DOLL.

EDISON
TALKING DOLLS

At Wholesale and Retail.

THE EMPIRE CITY ELECTRIC CO.

15 DEY STREET, NEW YORK.

THE BURTON ELECTRIC HEATER,
FOR ELECTRIC RAILWAY CARS.

No Smoke! No Gases! Economy in Space!

Normal use of Current, THREE AMPERES.

"They are giving us and the public entire satisfaction."—Richmond, Va., U. P. Ry. Co.
"The heat is pleasant, sufficient and economical."—Marlborough, Mass., Street Ry. Co.

FOR FURTHER INFORMATION, ADDRESS

THE BURTON ELECTRIC CO., RICHMOND, VA.

CARBON PLATES and CARBON BATTERIES
ELECTRIC LIGHT CARBONS.

MADE FROM NATURAL GAS BY PATENTED PROCESS.

— ADDRESS —

SOLAR CARBON & MANUFACTURING CO.,
95 & 97 FIFTH AVE., PITTSBURGH, PA.

WHIPPLE'S
Electric, Gas and Street Railway
FINANCIAL REFERENCE
DIRECTORY
For 1890.

CONTENTS:

List of all Electric Lighting and Power Stations, with Officers, Systems, Steam Plants, Day Circuits, Financial Standing and other data.
List of all Isolated Electric Light Plants.
List of all Gas Light Companies, with data.
List of all Street and Electric Railroads, with data.
List of all Telephone Stations.
List of all Electric, Gas and Street Railroad Associations, with Officers and Members.
List of all Manufacturers and Dealers in Electrical Supplies of any kind, with ratings.
List of all Bell Hangers, Engineers, Contractors, Electricians, Traveling Agents and the General Trade, with Financial Ratings.
Prices of Electric Light and Gas in every city and town.
And much other information of great value to the trade. Special attention given to the Domestic Electric Trade.

Send in your Subscriptions. See that you are Correctly Reported.

PRICE, $5.00; with Confidential Commercial Ratings, $10.00.
Advertising Rates made known on application.

THE FRED H. WHIPPLE CO.,
New York Office, 18 Cortlandt Street. DETROIT, MICH.

BOOKS ON ELECTRICAL SUBJECTS
Will be mailed to any address, postage prepaid, on receipt of price. Address,
ELECTRICAL REVIEW PUB. COMPANY,
13 Park Row, New York. P. O. Box, 3,329.

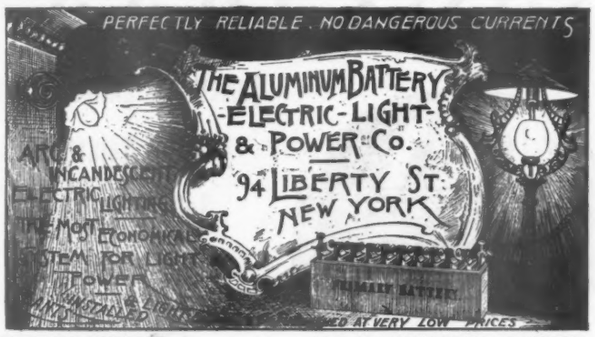
THE WESTON STANDARD
VOLTMETERS AND AMMETERS.

These instruments are the most accurate, reliable and sensitive, portable instrument ever offered. A large variety of ranges to meet the requirements of all kinds of work.
SEND FOR ILLUSTRATED CATALOGUE.

Address,
WESTON ELECTRICAL INSTRUMENT CO.,
Quitman, near Baldwin St., NEWARK, N. J.

THACKARA MANUFACTURING CO.,
DESIGNERS AND MAKERS OF
GAS, ELECTRIC and COMBINATION FIXTURES
For any Incandescent System.
Philadelphia, Pa.

Grimshaw Patented White Core
WIRES and CABLES.
FIRE, ACID, AND WATERPROOF. GRIMSHAW TAPE.
NEW YORK INSULATED WIRE Co.,
R. E. Gallaher, Secretary. J. W. Godfrey, Gen'l Manager. W. B. Dowse, Treasurer.
Sole Manufacturers, 649 & 651 BROADWAY, N. Y.
St. Paul, Minn., C. J. Thomson, Agt., 100 East Fourth Street.



BOSTON OFFICE, - - 339 WASHINGTON STREET.
NEW HAVEN OFFICE, - - - 94 CHURCH STREET.

P. MINTURN SMITH - President.
WILLIAM D. PERRY - Vice Pres't.
G. G. FRELINGHUYSEN - Secretary

CHARLES TREMAINE - Treasurer
JAMES W. EASTON — Electrician

THE EASTON ELECTRIC Co.
ELECTRICAL APPARATUS FOR ARC AND INCANDESCENT LIGHTING

Office 45 BROADWAY
New York.

TELEPHONES FOR EXPORT!!!

FOR SOUTH AMERICA, CENTRAL AMERICA AND WEST INDIES.

Genuine "BELL" Telephones, "BLAKE" Transmitters and Magneto Call Bells, or CHEAPER European made Instruments at Lowest Prices.

Those who care for PRICE ONLY send for the latter.

Those who consider durability and good service use the former.

Send for New Circular and Price List.

ALL EXPORT ORDERS MUST BE ADDRESSED TO

THE TROPICAL AMERICAN TELEPHONE CO., Ltd.,

95 MILK STREET, BOSTON. 18 CORTLANDT STREET, NEW YORK.

CONRAD N. JORDAN, President. E. COCORZA, Vice-Prest. & Treas. JAMES DUNNE, Secretary. J. R. BURDICK, Manager.

THE TRINIDAD-HEIMANN INSULATED WIRE CO.,

OFFICE, 49 LIBERTY STREET, NEW YORK. WORKS, HARRISON, N. J.

THE CELEBRATED TRINIDAD LINE WIRE. THE HEIMANN FIREPROOF INSULATED WIRE.

House Wire, Underground and Submarine Cables, and Solid System of Underground Wire, Manufactured by this Company.

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,000 c. p. 8 amp. Y	No. Lights 1,300 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required.	Weight of Dynamo.
C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1¼		530
E	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	3½		780
E	.....	20	.....	.....	12.5	3½		780
E	.....	.....	26	.....	13.0	3½		780
E	20	.....	.....	.....	15.0	3		990
E	.....	25	.....	.....	15.6	3		990
E	.....	.....	32	.....	15.0	3		990
E	.....	.....	.....	50	16.0	3		990
E	28	.....	.....	.....	21.0	4½		1,300

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,000 c. p. 8 amp. Y	No. Lights 1,300 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in Inches.	Belt Speed Required.	Weight of Dynamo.
C	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
C	.....	.....	45	.....	21.0	4		1,360
H	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
I	.....	50	.....	.....	30.0	6		1,750
I	.....	.....	64	.....	29.5	6		1,750
J	52	.....	.....	.....	38.0	8		2,290
J	.....	65	.....	.....	38.6	8		2,290
J	.....	.....	83	.....	38.0	8		2,290
K	64	.....	.....	.....	46.5	10		2,770
K	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12		3,300

THE NATIONAL CARBON CO

CLEVELAND, OHIO.

MANUFACTURERS OF

ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

SUBSCRIBE NOW FOR THE ELECTRICAL REVIEW.

"HAMMOND"

TYPEWRITER

SPEED UNEXCELLED.

Highest Awards, New York, London, Paris, Brussels, Boston, New Orleans, Etc.

THE HAMMOND TYPEWRITER CO.,

447-449 East 52d St., New York.

77 Nassau St., New York, 209 N. 8th St., St. Louis,
198 La Salle St., Chicago, 42 W. 4th St., Cincinnati,
300 Washington St., Boston, 116 S. 6th St., Philadelphia.

Vol. VI. 113 Liberty St., New York. Monthly, $2.00 Per Year.

THE STREET RAILWAY JOURNAL, 113 Liberty Street, NEW YORK.

CONTENTS.

Each issue contains 180 pages or more, including 40 to 60 pages of reading matter and illustrations.

A Directory of Street Railways in the United States and Canada.

A Directory of Manufacturers of street railway appliances and materials.

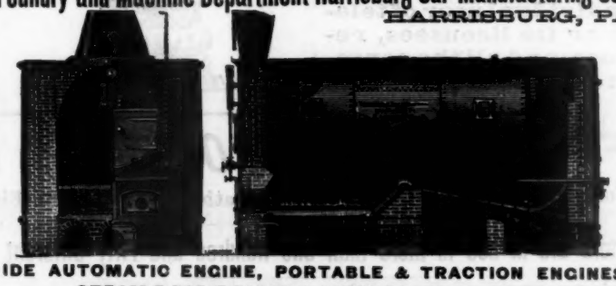
Is the Best Advertising Medium through which to reach Street Railways.

Weitmyer Patent Furnace,

MANUFACTURED AND SOLD BY

Foundry and Machine Department Harrisburg Car Manufacturing Co.

HARRISBURG, PA.



IDE AUTOMATIC ENGINE, PORTABLE & TRACTION ENGINES.

STEAM ROAD ROLLERS, BOILERS OF ALL DESCRIPTIONS.

New York Office, Messrs. Fleming & Kimball, 17 Dey Street.
New England Office, Messrs. John Post, Jr. & Co., 70 Kilby St., Boston.
Baltimore Office, Messrs. Thomas K. Carey & Bro., 26 Light St., Balt.

WESTERN OFFICE, MESSRS. ENGLISH, MORSE & CO., KANSAS CITY, MO.

Electric Light Installations

AND THE

Management of Accumulators.

BY SIR DAVID SALOMONS.

Fifth Edition. Revised and Enlarged.
WITH NUMEROUS ILLUSTRATIONS.

A General Survey of the Practice of Electric Lighting and the Management of Accumulators, with recommendations to assist in obtaining successful results.

PART I.

Description of Cells, Mode of Employment, Setting Them Up, and Accumulator House, Charging, Discharging and Failures; their causes and remedies.

PART II.

Engines, Dynamos, Motors, Switchboards, Switches, Instruments, Lamps and Wiring, Rules for Prevention of Fire Risks, Action of Cells with Dynamo, Methods of Working and Governing, Alternating Currents, Testing and Estimates.

PRICE, $1.50.

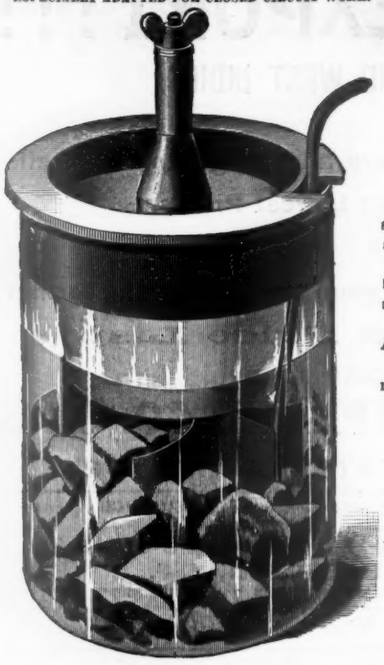
Copies of this book will be mailed, postage prepaid, to any address, on receipt of price.

Address

ELECTRICAL REVIEW,

P. O. Box 3329. 13 Park Row, N. Y.

ESPECIALLY ADAPTED FOR CLOSED CIRCUIT WORK.



GETHINS IMPROVED GRAVITY BATTERY,

MANUFACTURED BY THE

Gethins Electrical Manufacturing Company,

620 ATLANTIC AVE., BOSTON, MASS.

This Battery is a combination of the Daniell and Gravity Cells, and is much superior to either in economy in consumption of Zinc and Vitriol, great durability, uniform constancy and entire freedom from overflow of copper, thus rendering it a clean Battery at all times.

The Battery runs from 12 to 15 months **without any attention** except a renewal of evaporation, and saves **50 Per Cent.** in the expense of material. Its remarkable constancy is shown by a test covering a period of over 12 months, where on a constantly closed circuit it showed **no variation** in current.

The Gethins Battery is especially adapted for **Telegraph** and **Signal** work of all kinds, and on account of its **Absolute Constancy,** is especially adapted for Railway Signal Work.

This Battery has been adopted by the city of Boston for Fire and Police Telegraph Departments, there being in use now in that city alone **over 2,000 Cells.** Shipments are constantly being made to all parts of the country.

Battery, consisting of Glass Jar, Copper, Zinc and Porous Cup, $1.25 each.
Battery, without Glass Jar, - - - - - - 1.00 each.

DISCOUNT TO THE TRADE.

Quantity of Chemicals required for setting up Battery, as follows:

4 lbs. Blue Vitriol. 1 oz. Sulphate of Zinc. 8 oz. Mercury.

WE CAN FURNISH SUPPLIES, IF DESIRED, AT MARKET PRICES.

Address, GETHINS ELECTRICAL MFG. CO.,
620 Atlantic Avenue, Boston, Mass.

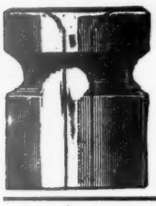
W. R. OSTRANDER & CO.
195 & 197 FULTON ST., NEW YORK.
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS, Electric & Mechanical Bells.
FACTORY,
De Kalb Avenue,
BROOKLYN.
Send for Illustrated Catalogue.

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY
THE BALL ENGINE CO
ERIE PA.

Eastern Agents, C. R. Vincent & Co., Room 16, 15 Cortlandt St., New York.

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Foot of Washington Street, JERSEY CITY, N. J.
Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

HYDRAULIC PRESSES.
ALL VARIETIES.
PUMPS, VALVES, GAUGES AND FITTINGS,
PUNCHES, SHEARS, BUFFING MACHINERY, &c.
WATSON & STILLMAN,
210 EAST 43D STREET, NEW YORK CITY.
Special Attention to Electrical Work.



Porcelain Electrical Supplies and Specialties,
MANUFACTURED BY
EMPIRE CHINA WORKS,
144 & 156 Greene St., GREENPOINT, BROOKLYN, E. D., N. Y.
Our Ware is HARD PORCELAIN, the BODY and GLAZE IDENTICAL, and GUARANTEED NON-CONDUCTIVE for all ELECTRICAL PURPOSES.

THE
American Bell Telephone Company,

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

THE
Horn, Brannen and Forsythe
Manufacturing Co.
(INCORPORATED.)

Designers and Manufacturers of

Gas and Combination Fixtures,

AND

ELECTROLIERS,

427 to 433 North Broad St.

PHILADELPHIA.

CORRESPONDENCE SOLICITED.

DURABLE, EFFICIENT, ECONOMICAL, CONVENIENT.

For Stationary or Railway Work, for Mining or Engineering Operations, the Sprague Electric Motors are Unexcelled.

Sprague Stationary Motors are in use in more than One Hundred and Fifty Different Classes of Industries.

Address all Correspondence to the

SPRAGUE ELECTRIC RAILWAY AND MOTOR CO.,
16 AND 18 BROAD STREET, NEW YORK.

EXCELSIOR ELECTRIC CO.,

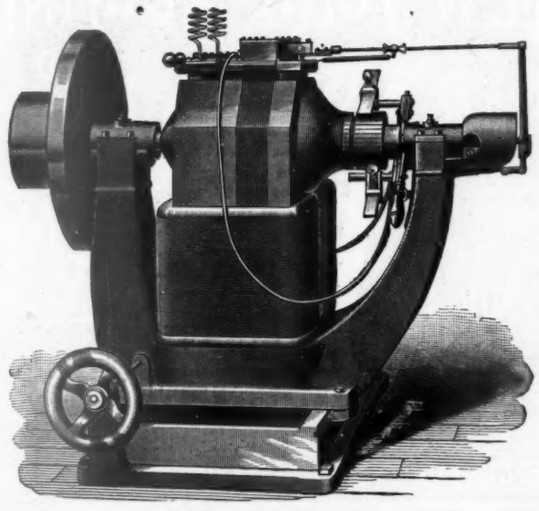
WILLIAM HOCHHAUSEN, ELECTRICIAN.

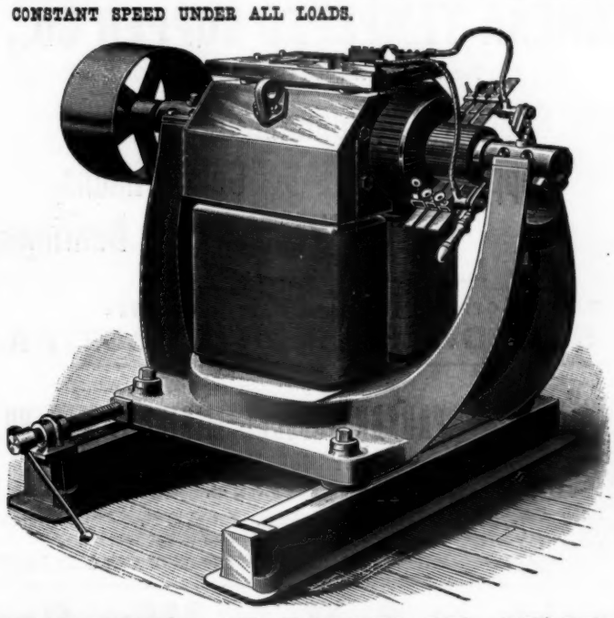
MOTORS

FOR ARC AND INCANDESCENT CIRCUITS.

WOUND FOR ANY CURRENT. PERFECT AUTOMATIC REGULATION

HIGHLY EFFICIENT AND ECONOMICAL. CONSTANT SPEED UNDER ALL LOADS.





OFFICE, 115 BROADWAY, N. Y. WESTERN OFFICE, 11 E. ADAMS ST., CHICAGO.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

BARE AND INSULATED WIRE,

Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

TRADE MARK "K.K."

For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the WASHINGTON CARBON CO.,

FACTORIES: WATERBURY, CONN.

NEW YORK OFFICE, 25 Park Place,

THOS. L. SCOVILL, NEW YORK AGENT.

DAFT ELECTRIC LIGHT COMPANY,

EXECUTIVE OFFICES, 115 BROADWAY, NEW YORK.

AGENCIES:

13 South 4th St., Philadelphia. 119 La Salle Street, Chicago.

Electric Railways and Power Stations,

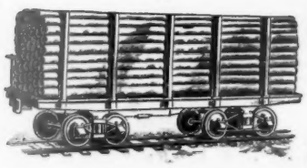
STATIONARY MOTORS, STORAGE BATTERIES.

DYNAMOS, 1 to 250 H. P. MOTORS, ½ to 100 H. P.

WORKS, JERSEY CITY, N. J.

STEVENS & BABCOCK,

EAST SAGINAW, MICH.



Electric Light Poles

A SPECIALTY.

ASK FOR PRICES.

Delivered any part of the United States.

EUREKA TEMPERED COPPER CO.,

Only Manufacturers of PURE COPPER Tempered for

Brush Copper, Commutator Bars,
Copper Wire, Gear Pinions,
Trolley Wheels, Bearings.

EASTERN OFFICE: 35 BROADWAY. | FACTORY: NORTH EAST, PA.

SUNLIGHT CARBONS

THE PARKER-RUSSELL MINING & MFG. CO.

MERMOD-JACCARD BUILDING,

Cor. Broadway and Locust St. Rooms 307 and 308.

ST. LOUIS.

UNIFORM IN QUALITY, LONG LIFE AND GOOD LIGHT

Washburn & Moen Mfg. Co.

WORCESTER, MASS.

MAKERS OF

IRON AND STEEL

MANUFACTURERS OF

Iron and Copper Wire for Electrical Purposes.

PATENT GALVANIZED TELEGRAPH & TELEPHONE WIRE,

In Long Lengths, Galvanized by our Patent Continuous Process.

The Standard with all Telegraph and Telephone Companies.

Since the first introduction of the Electric Telegraph Service, our patent wire, expressly manufactured for electric purposes, has filled every requisition as regards strength, evenness of quality, and conductive capacity.

Send for Price Lists and descriptive pamphlets, and "Hand-book of Wire in Electric Service." Sent free on application.

New York Warehouse, 16 CLIFF STREET.

Chicago Warehouse, 107 & 109 LAKE ST.

E. M. BICKETTS COMPANY, Limited,

LAYERS AND REPAIRERS OF

Submarine Cables,

25 CORTLANDT and 19 DEY STREETS,

New York City.

A. SEELY, President. W. G. SELLERS, Gen. Manager.

GENUINE INGOTS & MANUFACTURES REG. TRADE MARKS

PHOSPHOR-BRONZE

INGOTS, CASTINGS & MANUFACTURES.

THE PHOSPHOR BRONZE SMELTING CO. LIMITED

512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS

NEW YORK BELTING AND PACKING CO.

LARGEST BELTS IN THE WORLD.

RUBBER BELTING, PACKING, HOSE,— —MATS, MATTING, STAIR-TREADS.

15 PARK ROW, NEW YORK.

(OPPOSITE ASTOR HOUSE.)

J. H. CHEEVER, TREAS. J. D. CHEEVER DEP'Y TREAS.

ROYCE & MAREAN,

DEALERS IN

ELECTRICAL APPARATUS

Telegraph and Telephone Supplies,

No. 1408 Penna. Avenue,

Opp. Willard's Hotel. WASHINGTON, D. C.

SperryElectric Company,

Factory 195-207 Canal Street, Chicago, Ill.

MANUFACTURERS OF THE

Improved Sperry High and Low Tension Systems of Arc Lighting,

Claiming the Highest Efficiency, Reliability and Durability. Perfect Regulation.

Corliss Engines

Of the highest type, in all sizes, are made by

The Lane & Bodley Co.

CINCINNATI, O.

The merits of their engines are described in an illustrated pamphlet, which will be sent to any one interested.

The GOODRICH HARD RUBBER Co.

AKRON, OHIO.

Manufacturers of HARD RUBBER GOODS FOR ELECTRICAL Purposes

SPECIALTIES OF ALL KINDS TO ORDER

SEND FOR CATALOGUE.

S. Y. L'HOMMEDIEU & CO., Eastern Agents, 65 Reade St., N. Y.

SOFT RUBBER GOODS

FOR ELECTRICAL PURPOSES

TUBING ALL SIZES

PURE RUBBER TAPE • FRICTION TAPE

Pure Sheet Rubber Etc.

Samples and prices upon application.

Address THE B. F. GOODRICH CO.

AKRON RUBBER WORKS AKRON, OHIO.

S. Y. L'HOMMEDIEU & CO., Eastern Agents, 65 Reade St., N. Y.

FARADAY CARBON Co.,

ELECTRIC LIGHT CARBONS, PITTSBURGH, PA.

WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK.

MANUFACTURERS OF

Weatherproof and Underwriter's Wire

AND WESTERN AGENTS FOR

A. G. DAY'S KERITE WIRE.

THE EDDY ELECTRIC M'F'G CO.

MANUFACTURERS OF

AUTOMATIC ELECTRIC MOTORS,

In all sizes, from 1-2 H. P. upward; High Efficiency; Perfect Regulation; Superior Workmanship; Ease of Management; Remarkable Simplicity, etc., etc.

DYNAMO ELECTRIC MACHINES,

For Electro-Plating, Electrotyping, Copper Refining, Etc. No Reversing. No Water. No Noise. No Spark.

SATISFACTION GUARANTEED.

THE EDDY ELECTRIC M'F'G CO., WINDSOR, CONN.

NEW YORK, 33 Church St., BOSTON, 111 Arch St., PHILADELPHIA, 506 Commerce St., KANSAS CITY, Rialto Building, NEW ORLEANS, 106 Carondelet St.

A MAP OF THE UNITED STATES.

A large, handsome Map of the United States, showing North and South Dakota, mounted and suitable for office or home use, and issued by the

BURLINGTON ROUTE,

will be furnished responsible parties free on application to the undersigned.

PLAYING CARDS.

For 10 cents, either in postage or by applying at Room 12, C., B. & Q. R. R. General Office, corner of Adams and Franklin streets, Chicago, you can obtain a pack of best quality Playing Cards.

P. S. EUSTIS,
Gen'l. Pass. & Ticket Agent, C., B. & Q. R. R.,
CHICAGO, ILL.

FOR SALE.

1-2 PRICE.

NEW ENGINES.

Two 40 H.P. Armington & Sims' Automatic Engines.
One 50 H.P. Russell Automatic Engine.

A. L. IDE & SON,
SPRINGFIELD, ILL.

INTRODUCING ENTIRELY NEW PRINCIPLES.

Pat. Mar. 19, 1889. THE OLD STYLE.

THE ACME LINK BELT

IS MADE ONLY BY THE

Page Belting Company, Concord, N. H.

BRANCHES: Boston, New York, Chicago, San Francisco. Also, manufacturers of all the staple grades of Leather Belting and Lacing. Send for Illustrated Catalogue—a valuable treatise on belting, Free.

ELECTRICAL MEASUREMENT
Instruments and Batteries of the Very Highest Grade.
Precision and Constancy, Quality and Finish the Best in the World.
Catalogue of Standard Test Instruments furnished upon application.
THE E. S. GREELEY & CO.,
5 AND 7 DEY ST., NEW YORK.

WELLINGTON
Belt Holder
The simplest, cheapest and handiest device in existence for shifting Dynamo Belts. Please write for circulars to
W. R. SANTLEY & CO.
WELLINGTON, O.

ELECTRICAL REVIEW BINDER FREE

The Electrical Review will send a FREE BINDER to every subscriber in the U. S. and Canada who sends $3.00 for a year's subscription.

Address,
Electrical Review, 13 Park Row, N.Y.

ELECTRICAL DICTIONARY

By EDWIN J. HOUSTON, A. M.

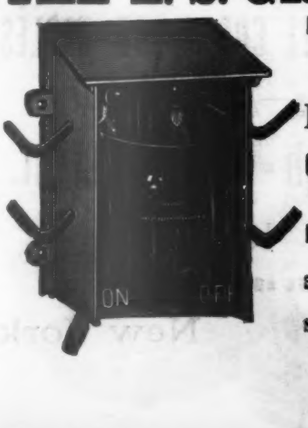
655 Pages; 396 Illustrations; Cloth.

Gives a clear definition of the word, term or phrase, and a brief statement of the principles of science involved in the definition, with illustrations where necessary.

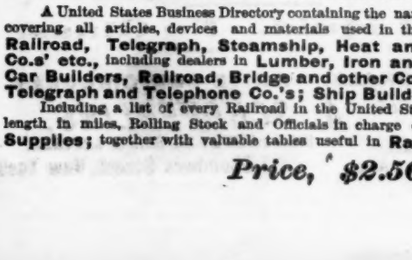
Sent, postage prepaid, to any address on receipt of $2.50.

ELECTRICAL REVIEW,
13 PARK ROW,
P. O. Box 3329. New York.

THE E. S. GREELEY & CO.,



Nos. 5 & 7 Dey St., New York
Manufacturers and Importers of and Dealers in
Telegraph, Telephone
— AND —
Electric Light Supplies
AGENTS FOR
Cleveland Arc Light Cut Outs & Gang Switches
Cleats, Rosettes, Moulding, Pins, Cross-Arms, Brackets. Insulating Tapes.
Rubber, Porcelain and Glass Insulators
WIRES OF ALL KINDS.
Silk & Cotton Covered Flexible Conducting Cord of various sizes for Incandescent Lighting.
Spikes, Pole Steps, Lag Screws, Drive Screws. Turn Buckles. Etc.



Just Issued,

FOR 1890,

THE RAILROAD, TELEGRAPH & STEAMSHIP BUILDERS' DIRECTORY.

A United States Business Directory containing the names of manufacturers and dealers, covering all articles, devices and materials used in the construction and operation of Railroad, Telegraph, Steamship, Heat and Power, Electric Light Co.s' etc., including dealers in Lumber, Iron and Steel. Locomotive and Car Builders, Railroad, Bridge and other Contractors; Electric Light, Telegraph and Telephone Co.'s; Ship Builders and Materials.

Including a list of every Railroad in the United States, Canada and Mexico, giving length in miles, Rolling Stock and Officials in charge of ordering and Purchasing Supplies; together with valuable tables useful in Railroad Construction.

Price, $2.50.

JOHN A. SEELY, President. JAMES A. TAYLOR, Treasurer and Secretary.

SEELY & TAYLOR MANUFACTURING CO.,

14 Cortlandt Street, New York City.

Seely's PATENT Copper Beveled Edge Sleeves AND Tee Connectors

USED FOR SPLICING AND BRANCHING FOR UNDERGROUND AND AERIAL CABLES AND HOUSE WIRING.

FIG. 1.

Fig. 1 represents Copper Tee used for branching from main cables, as shown in Fig. 2.

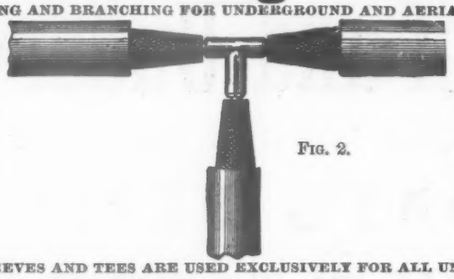


FIG. 2.

Fig. 3 represents a Copper Sleeve used for straight connections for continuation of cables.

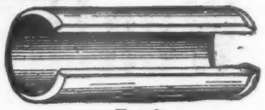


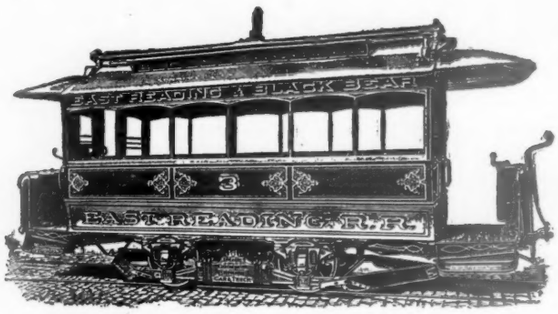
FIG. 3.

These sleeves are bevel edged, thereby preventing abrasion of insulation when placed over same.

THESE SLEEVES AND TEES ARE USED EXCLUSIVELY FOR ALL UNDERGROUND WORK IN NEW YORK CITY.

SEELY & TAYLOR MFG. CO., - - - 14 Cortlandt St., New York City.

WILL REMOVE MAY 1st to 24 CORTLANDT STREET and 19 DEY STREET.



JOHN STEPHENSON COMPANY

LIMITED,

NEW YORK.

Street Cars

FOR

Electric Motors.

Manufacturers

H. E. & C. BAXTER,
13 Fulton Street, Brooklyn, E. D.

Industries.

— A —

Journal of Engineering, Electricity & Chemistry

— FOR THE —

MECHANICAL AND MANUFACTURING TRADES.

PUBLISHED EVERY FRIDAY.

ANNUAL SUBSCRIPTIONS.	Thick Paper.	Thin Paper.
GREAT BRITAIN, Post Free	$6 00	$6 00
THE UNITED STATES, CANADA and COUNTRIES INCLUDED IN THE POSTAL UNION, Post Free	9 00	8 00
INDIA, CEYLON, STRAITS SETTLEMENTS, CHINA, JAPAN, &c., Post Free	10 75	9 00

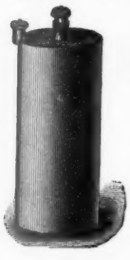
SUBSCRIPTIONS PAYABLE IN ADVANCE TO

GEO. CAWLEY, 358 STRAND, LONDON, W. C.

Manchester, 70 Market St.; Glasgow, 93 Hope St.; Yokohama (Japan), 32 Main St.

American Subscriptions to "Industries" are received by the Publisher of the ELECTRICAL REVIEW, 13 Park Row, New York.

DR. GASSNER'S DRY BATTERY



Acknowledged by experts to be the Best Open Circuit Battery in the Market, the most durable and convenient for

Electric Bells, Gas Lighting, Telephones, Signals, Electric Clocks, Stationary Batteries for Physicians and Many Other Uses.

No Liquid. No Glass.

HIGHEST TESTIMONALS. WRITE FOR CIRCULAR.

For Sale by The Western Electric Co. CHICAGO, ILL. and California Electrical Works, SAN FRANCISCO, CAL.

A. SCHOVERLING,
SOLE AGENT AND MANUFACTURER,
111 Chambers Street, New York.

EDISON MACHINE WORKS,

Schenectady, N. Y.

MANUFACTURERS OF

INSULATED WIRES, FLEXIBLE CORDS AND CABLES,

—FOR—

Telephone, Telegraph AND Electric Light.

JAMES F. KELLY.

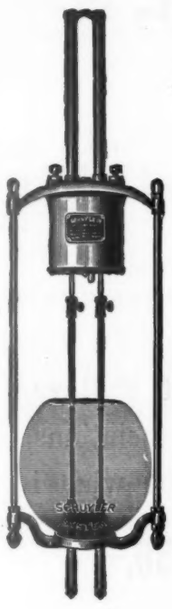
GENERAL SALES AGENT,

19 Dey Street, New York.

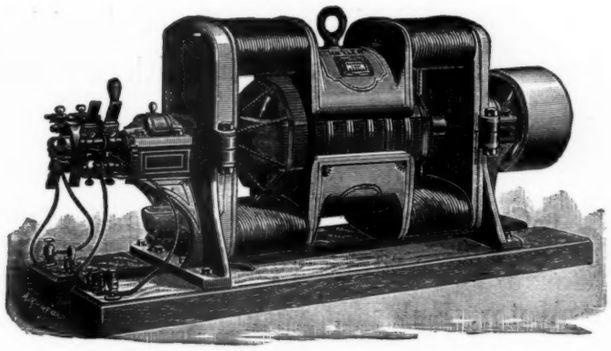
THE

SCHUYLER ARC LIGHTING SYSTEM

Perfect Automatic Regulation.
Absolutely Steady Lights.



IMPROVED SCHUYLER DYNAMO.



WITH VENTILATED ARMATURE.

The Ventilated Armature Ensures a Cool Running Machine and No Burnouts.

THE SCHUYLER ELECTRIC CO., MIDDLETOWN, CONN.

The Mitchell Vance Company

(SUCCESSOR TO MITCHELL, VANCE & CO.)

DESIGNERS AND MAKERS OF

ARTISTIC

Electroliers & Combination Fixtures

FOR ANY SYSTEM OF INCANDESCENT ELECTRIC LIGHTING.

The feeling is growing that these goods should be specially adapted to the light medium; to meet this want New Designs of Artistic merit and unexcelled finish have been originated which commend themselves to intending purchasers, being shown in Parlors illuminated by Electric light.

Architects and Decorators Designs and suggestions carried out with fidelity to the given motive.

MANUFACTORY, 24th & 25th Sts. & 10th Ave.

SALESROOMS, No. 836 & 838 BROADWAY, NEW YORK.

EXTRACT FROM THE REPORT

— OF —

DR. SCHUYLER S. WHEELER,

— ON —

Underground Arc Light Wires in New York.

The line in 125th Street, 2,000 feet in length, is laid in the small ducts of the Johnstone system of conduits. The cable is a ***BISHOP GUTTA PERCHA WHITE CORE,*** and was laid immediately after the order for the work was given. The cable was connected to overhead arc light wires by running it up in a two-inch iron pipe fastened to the outside of an ordinary city electric lamp post. Connections were made with lights in front of stores by carrying the cable from the ducts in iron pipes under the sidewalk and up the front of the stores. This line has been in continuous use for two months, carrying a pressure of 2,500 volts, and it shows an actual rise in insulation with age and use, as will be seen from the following tests:

Jan. 11th, 1,100 Megohms.
Feb. 12th, 1,800 Megohms.
April 12th (including eight arc lamps and branch leads), 2,000 Megohms.

All our White Core India Rubber Insulation is Same Quality as on above cables.

BISHOP GUTTA PERCHA CO.,

420-426 EAST 25TH ST., NEW YORK.

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.

THE OLD RELIABLE —LEFFEL— WATER WHEEL

SEND FOR CATALOGUE.

JAMES LEFFEL & CO. SPRINGFIELD, O., OR 110 LIBERTY ST., N.Y.

BROWNLEE & CO.

DETROIT, MICH.,

DEALERS IN

Poles, Cross Arms, Pins, Etc.

RED PINE OCTAGONAL POLES

for electric railways and electric lighting. Perfectly straight. The handsomest, strongest and most satisfactory pole in the market. 34 to 54 feet in length.

CEDAR TELEGRAPH POLES

of all sizes always in stock.

CROSS ARMS AND PINS

at lowest prices.

SEND FOR CIRCULARS.

R. T. WHITE,

12 Pearl St. (Room 6), BOSTON, MASS.

NO BOLTS THROUGH THE RAILS.

DAISY CHAIR.

IMPROVED

PATENTED MATERIAL FOR STREET RAILWAY ROADBEDS.

BEST MATERIAL. LOWEST PRICES. CORRESPONDENCE SOLICITED.

THOMAS ASHBURNER, Western Agent, Kansas City, Mo.

Made any Height and Size desired. Patent allowed.
Sample Chair and Section of Rail Sent, Express Prepaid, to Prospective Purchasers.

CENTRAL ELECTRIC COMPANY,

116 and 118 Franklin Street,

CHICAGO.

Every central station man should have one of Davis' Hand Books containing 130 pages of just the right sort of information, with 30 illustrations, all bound in convenient form for the pocket.

Among the contents are articles on the Arc Lamp, the Incandescent Lamp, Batteries, Boilers, Dynamos, Electrical Units, General Formulæ for Wiring for any System, the Steam Engine, Rules for Computing Speed and Diameters of Pulleys, various Wire Gauges, the Electric Motor, Rules of various Underwriters' Associations, Storage Batteries, all compiled by a practical man who knows from experience what is needed.

Price, in Cloth, $0 75. Price, in Leather, $1 50.

Central Electric Company,

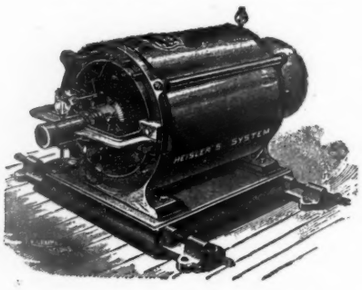
116 and 118 Franklin Street, Chicago.

THE

HEISLER PATENT LONG DISTANCE INCANDESCENT ELECTRIC LIGHT SYSTEM

Awarded the Highest Distinction, a Gold Medal, at the Paris Exposition, 1889.

UNEQUALLED FOR DISTRIBUTION OVER WIDE AREAS.



Specially adapted for Street, Commercial and Domestic Illumination from Central Stations. Plant may be located where Power can be secured Cheapest, even if Miles Distant from the Lighting. Safety, Reliability, and Financial Success fully Demonstrated. Plant of Wiring the Simplest, Cheapest, and Most Efficient. Strictly Series. Lamps, 10 to 100 Candle Power. Long Life without Blackening. Dynamo Self-Contained and Automatic.

SEND FOR CIRCULARS. CORRESPONDENCE SOLICITED.

HEISLER ELECTRIC LIGHT CO., 809 to 817 South Seventh St., ST. LOUIS, MO.

AWARDED THE GRAND PRIZE

SEND FOR THIS BOOK
FREE ON APPLICATION.
THE BABCOCK & WILCOX CO
WATER TUBE
STEAM BOILERS
30 CORTLANDT ST. N.Y.
107 HOPE ST. GLASGOW, SCOTLAND.
BRANCH OFFICES
MANUFACTORIES IN UNITED STATES, SCOTLAND, FRANCE, GERMANY & AUSTRIA.

AT LATE PARIS EXPOSITION.

Something New! One, two, three, and four spindle drills for light work.

DRILLS

The most useful patented improvement in drill presses for years is applied.

SENSITIVE

Spindles driven with single, endless belts. Large driving pulleys, tightener and variable speeds provided.

Over 1,000 in use. Buy the **latest** and **best**. Special machinery to order. Catalogue of fine tools free.

Dwight Slate Machine Co.

HARTFORD, CONN.

REGISTER SPRINGS A SPECIALTY.

THE INCANDESCENT LAMP.

WHAT USERS SAY!

"I have five lamps out of a group of eight, which have burned 10 hours per day for the last nine months and 13 days, which makes a burn of 2,830 hours, with lamps looking almost as good as new."—East Liverpool, O., Western Electric Co.

"The Sawyer-Man lamps underwent the severest test during the last two months. They are the best and finest in the market. No other lamps could stand the heavy strain and vibration at the Fair building."—An Exhibitor at the American Institute Fair, 1889.

"We have lamps still burning that have been in use ever since we put in the plant."—Cowperthwait & Co., Brooklyn, N. Y.

"Our Sawyer-Man lamps have given remarkably good service, averaging over 1,500 hours, and with a good light."—G. H. Nichols & Co., Laurel Hill, L. I.

"We have lately been using your lamps, which give us better satisfaction than the ——— lamps in use heretofore."—West Point, Neb., Electric Light and Power Co.

"They give a splendid, white, well-distributed light."—Vancouver, B. C., Electric Illuminating Co.

"The average life of the lamps on our plant up to last June was 2,800 hours. Since September we have lost very few lamps, so that the average life is very much greater than this."—Dr. W. A. Drysdale, Philadelphia, Pa.

"We are highly pleased with the lamps, and think they will have much better life than the ——— make."—Hutchinson, Kan., Water, Light and Telephone Co.

"Some of the first lot of Sawyer-Man lamps, put in over two years ago, are still in use."—Saxton & Thompson, Troy, N. Y.

"The lamps furnished us under your contract have given excellent satisfaction. We have quite a number of lamps now in use and burning brightly, which have been in constant use, on an average of six hours per day, since January 2, 1888."—Portland Block, St. Paul, Minn., September, 1889.

"We consider them superior to the lamp furnished us by others."—Electric and Water Supply Co., Neillsville, Wis.

"One of the lamps has been burning since August 1, 1888, making 16 hours each day, and is still a good lamp. We think that as you make such a good lamp, you are entitled to have their merits acknowledged by those who are daily using them."—F. E. Coward & Co., Philadelphia, Pa.

SAWYER-MAN SAWYER-MAN
ELECTRIC COMPANY,

New York, Boston, Chicago, Pittsburgh, Pa., Cincinnati, Portland, Ore., San Francisco, Dallas, Tex., Charlotte, N. C., St. Louis, Mo.

Fort Wayne Electric Company,

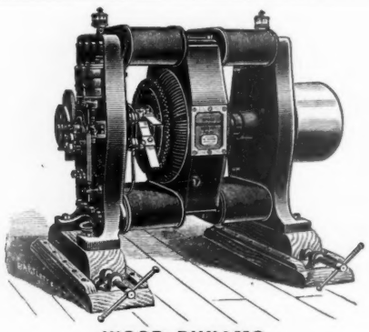
FORT WAYNE, IND.

The most carefully worked out and Complete Alternating System of Electric Lighting in existence.

ARMATURES AND CONVERTERS GUARANTEED.

12 16-candle-power Lamps to the mechanical horse power guaranteed

CORRESPONDENCE SOLICITED.



WOOD DYNAMO.

MANUFACTURERS

—OF THE—

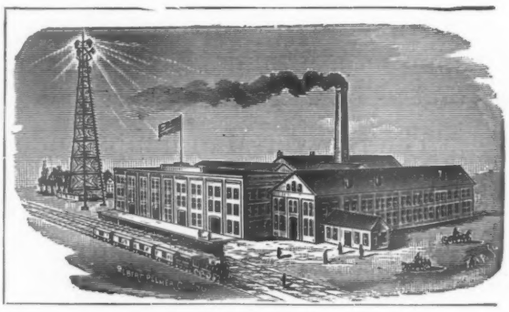
Slattery Induction System

OF INCANDESCENT LIGHTING,

—AND THE—

"WOOD" SYSTEM

OF ARC LIGHTING.



Main Office and Works, Fort Wayne, Ind.

NEW YORK OFFICE, Rooms 25 and 27, 115 BROADWAY,

H. C. ADAMS, Manager.

Manhattan Electric Light Co., 511 Broadway, Sole Licensees and Agents for N. Y. City and Brooklyn

CHICAGO OFFICE, 185 Dearborn St., W. J. BUCKLEY, Manager.

PHILADELPHIA OFFICE, 907 Filbert St., G. A. WILBUR, Manager.

PITTSBURGH OFFICE, 533 WOOD STREET.

SAN FRANCISCO OFFICE, 217 SANSOME STREET.

F. ADAMS SUC'S, CITY OF MEXICO.

The Tucker Electrical Construction Co.

GENERAL CONTRACTORS,

AUTHORIZED AGENTS OF THE

MATHER ELECTRIC CO.

Of Manchester, Conn.,

AND THE

PERKINS ELECTRIC LAMP COMPANY,

Of Hartford, Conn.

14-20 WHITEHALL ST., NEW YORK CITY.